MONOGRAPH

OF THE

BRITISH CICADÆ

OR

TETTIGIDÆ.

BY

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AUTHOR OF A 'MONOGRAPH ON BRITISH APHIDES.'

. . . . . "and flashed as those
Dull coated things that making slide apart
Their dusk wing-cases, all beneath them burns
A jewell'd harness ere they pass and fly."

"The small becomes the dreadful and immense."

"'Ακρίδι τᾷ κατ' ἄρουραν ἀηδόνι καὶ δρυοκοίτα
τέττιγι ξυνὸν τύμβον ἔτευξε Μυρὼ,
παρθένιον στάξασα κόρα δάκρυ; δισσὰ γὰρ αὐτᾶς
παίγνι' ὁ δυσπειθὴς ᾤχετ' ἔχων 'Αΐδας."

Epigram of Anyté.

VOLUME II.

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ABBREVIATED TITLES OF THE WORKS OF AUTHORS

Quoted in the Synonyms of Species.

The following names and works of authors may be added to the bibliographic list, given at the commencement of the first volume.

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January, 1891.] [In Eight Parts.—Part V.

MONOGRAPH

OF THE

BRITISH CICADÆ,

OR

TETTIGIDÆ,

ILLUSTRATED BY MORE THAN

Four Hundred Coloured Drawings.

BY

GEORGE BOWDLER BUCKTON, F.R.S., &c.,

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"Sole sub ardenti resonent arbusta Cicadis."

"The small becomes the dreadful and immense."

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BRITISH CICADÆ.

VOL. II.

ACOCEPHALINÆ.

Some of the genera and species comprised in the above section possess very definite and salient characters, whilst others show morphological details which are much less obvious, and divergencies which urge themselves less on the attention. The more cogent the arguments become in favour of the doctrine of the mutability of species, the more necessary will be the task of the future worker to review what has been already done in synonymy, and to decide on the claims which certain groups have to separate themselves from their allied neighbours.

Under such like considerations Dr. Victor Signoret, in his "Essai sur les Jassides," * eliminates certain genera from Fieber and Puton's Catalogues, taking for his primary guide the position of the ocelli, which he maintains to be very important as a character—"utile et facile à constater, car il manque très-rarement." Thus he groups the Acocephalides of Puton and "les Jassides ou Cicadelles" (which last names he considers to be synonymous) under two heads, *viz.*, those genera which show the ocelli on the vertex itself, and those which show themselves on the border of the head.

Amongst the first he places the insects represented in the British Fauna as *Eupelix*, *Acocephalus*, and *Strongylocephalus*. Amongst the second he places

* Extrait 'Ann. de la Soc. Entomol. de France,' Aout, 1878.

Platymetopius, "et plusieurs genres encore mal définis," such as *Deltocephalus*, &c.

The ocelli of *Paramesus*, he remarks, are to be found on the vertex, but they do not touch the head-border, and are not placed on the ideal line traced from eye to eye, and passing near to the summit of the head.

I may remark that if the ocelli could in all cases be seen, their position on the head would doubtless furnish very useful classificatory characters. But, so far as my experience goes, in many cases they fail to show themselves, and in other cases they have their representatives as mere spots of pigment; quite unlike the definite lens-like bodies on the crowns of *Tettigonia* or *Cicadetta*.

The limbus, appendix, or membranous fold on the elytron is, by its presence or otherwise, a good character for species, but, as a rule, not so much so for genera. The genus *Tartessus* has not yet found a representative in Britain. It has the peculiarity of showing this limbus far over the point of the elytron, encircling four, instead of three, of the apical cellules.

The characters of the head and the abdominal parts of the males of *Eupelix* are so marked, that there are good reasons for erecting the species into a group by themselves, as has been suggested by Sahlberg.

As we have, however, only one undoubted English species, I have not thought it necessary to cut it out of the Acocephalidæ.

In a general way it may be said that the male pygofer of the Acocephalidæ is on a type of two styles, two oblong plates, two genital valves, and a penis. Above these is placed the cauda or anal tube; which appendage, there is reason to believe, is perforated, and ends with a longitudinal excretory slit.

The female pygofer contains two thin toothed saws, and two laminated rasp-like plates, all of which parts are enclosed in the large exterior valves to be seen on the under side, and formed by the chitinous plate or conical folding of the pygofer.

In taking a general bird's-eye view of the Acocephalidæ, we may make the following remarks for facilitating their identification :—The curious development of the head of *Eupelix* renders its naming easy. The banded character of the elytron of the males in *Acocephalus* proper will call for due attention. The contrasted and raised nervures on the elytra of *Paramesus* will afford a clue as to the correct placing of specimens, as also will the almost entire loss of the limbus, point out *Graphocrærus*, and one or two others. Once more, the long style-like ending to the pygofer of *Doratura*, and the strong striations on the head and pronotum of *Glyptocephalus*, will be regarded as characters of moment and significance.

Genus XXVII.—EUPELIX, *Germar*.

Head broad, triangular, foliaceous, and very thin. Eyes moderate in size, and placed half above and half below the thin plate which divides the vertex from the frons (*englobés*). Frons with a strong carina, near to which, and on the upper surface, are placed the ocelli. Gulæ large. Rostrum short. Elytra subcoriaceous, with strong nervures and three discoidal cells. Limbus very narrow, and extending round four apical cellules. Abdomen of the male provided with a genital valve. Legs shortly spinose.

Eupelix cuspidata, *Fab.* Plate XXXVIII., figs. 2 to 2*b*, and Plate XXXIX., figs. 1, 1*a*.

Cicada cuspidata, Fab.
,, *depressa*, Fab.; Sign. pl. i. fig. 1.
Eupelix cuspidata, Germ.; Fall.; Flor; Marsh.; Kirschb.; Sahlb.; Sign. pl. i. fig. 3; Scott; Edw. pt. ii. p. 25.
Eupelix producta, Germ.; Burm.; Sign. pl. i. fig. 2.
,, *spathulata*, Burm.; Kirschb.; Sahlb.

This singular insect is very variable, both as to its colouring and as to the proportions of its flat and leaf-like head. The three varieties noted in the synonyms may be sometimes taken in company, but the differences to be noted in them "are more differences of degree" than of a truly specific kind; thus there appear to be good reasons for regarding them as one.

Male. Head deltoid, with curved edges. General colour of the insect ochreous-grey. Eyes reddish, or in older specimens brown. Central keel rather pronounced. Head as long as the pronotum and scutellum taken together. Rostrum very short. Abdomen fusiform, ochreous, with smoky sides and a stripe down the dorsum. Legs ochreous, with fine outer and inner spines. Elytra greenish, with marked whitish nervures, forming three discoidal cells. The nervures often finely punctate. Limbus narrow, bounding four apical cells. Wings with the third nervure united to the second by a bifurcation or a small transverse line (variable).

The female is paler in colour than the male. Fieber represents the last abdominal segment with three lobes. The pupa has a pointed head, with a marked central keel. The elytral and the wing cases are green and acuminate. Colour much paler, and sometimes almost white. Abdomen somewhat mealy and deeply ringed, each segment provided with two brown spots. Cauda very pointed.

This is not a common species, but sometimes it may be taken fairly numerously at Haslemere, on grasses growing on sandy banks, in June and July.

Size of body, 0·27 inch, or 7·00 millimètres.

Genus XXVIII.—STRONGYLOCEPHALUS, *Flor.*

Vertex produced to an obtuse angle, transversely striated. Frons divided from the vertex by a thin edge, near to which the ocelli appear as black spots, situated about half-way between the eyes and the

vertical point. Pronotum, taken with the scutellum, nearly twice the length of the head; striated transversely. Elytron coriaceous, rather short, and without a limbus. Wings as in *Acocephalus*, the next genus. Hind legs spined on the outer, and finely ciliated on the inner, sides. First tarsal joint rather longer than the other two taken together. Genitalia of the males complex, the pygofer ending with two pairs of, or four, unequal projecting processes.

Only two species hitherto have been recorded as British.

STRONGYLOCEPHALUS AGRESTIS, *Fall.* Plate XXXIX., figs. 2 to 2 *d.*

Cicada agrestis, Fall.
Strongylocephalus agrestis, Flor; Kirschb.; Scott; Sahlb.; Sign., Ess. Jas. 44, pl. 2, fig. 18; Edw. pt. ii. fig. 5, p. 18.

Male. Variable both in colour and size. Some specimens are very dark, others rufous-yellow, and others bright and mottled with brown spots. Head gibbous, ochreous-brown, with the ocelli (or their representatives) near to the anterior vertex. Transverse striations in the head and pronotum obvious. Scutellum almost immaculate. Elytra rather longer than the abdomen, with brown bars and spots chiefly disposed along the nervures. Costa with twelve or more dark spots. Legs pale; the front pair banded with black. Anal nerves on the wings stouter than the rest. Head in profile obtuse, and showing a sharp ridge. Pygofer with two pairs of cornua and a ciliated cauda. Free portion of the penis subcylindrical, and barbed at the apex (Edwards).

Female. Greyish yellow, and larger than the male. The dark blotchings on the elytron much reduced in number, and sometimes wanting.

M. Signoret figures the pygofer in profile; and thus the long processes noted above are folded on each other, and do not appear as in my plate.

Size of body, 0·21×0·09 inch, or from 6·0 to 7·0 millimètres.

Not common, but sometimes locally numerous. Marshy ground at Chobham; Norwich, and elsewhere.

STRONGYLOCEPHALUS MEGERLEI, *Scott.* Plate XL., figs. 3 to 3 *b*.

Strongylocephalus Megerlei, Ent. Mo. Mag. xi. 122, 2; Signoret, Ess. Jas. pl. ii. fig. 19; Edw. pt. ii. p. 18.
Amblycephalus irroratus, Curt. (?).

Colour yellow, more or less spotted with brown. Under-side black, and spotted with yellow. Head somewhat rounded, with a broad anterior border, on which two black dots (or ocelli) are conspicuous. Pronotum striated, and, taken with the scutellum, longer than in *S. agrestis.* Elytra also rather more pronounced in the bands and spots, and a little broader. Frons yellow, with yellow-brown streaks.

From the few specimens that I have examined, I should hesitate to separate *Megerlei* from *agrestis.* Probably the differences which are said to exist can be more easily perceived in continental specimens, where the insect seems to be more common. Some stress is laid on the more or less concave hind margin of the ventral plate and the depth of the notch.

Mr. Edwards says:—"Marshes. Hitherto rare. Northumberland. Surlingham and Booton, Norfolk."

My drawing is from a capture made at Ranworth, Norfolk.

Size, 0·27 inch, or 7·0 millimètres.

Genus XXIX.—ACOCEPHALUS, *Germar.*

Body oblong. Head with the eyes hardly broader than the pronotum, slightly emarginate at the base. Vertex angularly produced. Ocelli placed near its anterior margin, and between themselves twice the distance from the eyes. Frons slightly convex. Rostrum slender, and longer than the clypeus. Antennæ inserted within foveæ near the temples; second joint cylindrical, a little longer than the first. Eyes moderate or small. Pronotum broadly rounded forward. Scutellum shortly triangular; apex acute. Elytra narrow, rounded behind, and without an appendix or limbus. Wings furnished with five longitudinal veins, the first approximating to the middle of the marginal costal vein, and joined before the apical with the second transverse vein. Intramarginal vein obsolete. In some species the wings are rudimentary, whilst in others the bounding nervure is seen only partly developed.

Acocephalus albifrons, *Linn.* Plate XL., figs. 1 to 1*d*, and Plate XLI., figs. 1 to 1*c*.

Cicada albifrons, Linn.
Aphrodes testudo, Curt., also *concinna.*
Acocephalus arcuatus and *confusus*, Kirschb.
,, *albifrons*, Flor; Marsh.; Sahlb.; Sign. pl. ii. fig. 14; Edw. pt. ii. p. 21.
,, *nigropunctatus*, Sahlb., *var.*
,, *interruptus* and *polystolus*, Scott, *var.*

Variable as to colour, marking, and size.

Male, occurs in the macropterous and brachelytrous form. Head, pronotum, and scutellum ochreous, or ochreous-yellow. In some individuals these parts are spotless, but in others they are marked by variously-

shaped brown patches. Elytra pale hyaline, or shining white, with three dark brown or blackish bands crossing the same.

Some specimens show their bands disjointed with warm brown, so as to give the insect a mottled appearance. The nervures of the elytra cannot always be traced to their terminations, but, not counting the claval suture as a vein, there are five apical and three discoidal cellules, and no limbus. The wings are as in *Strongylocephalus*, figures of which may be found on the plates. The antennæ rise from deep pits or foveæ near to the frons; the basal and second joints being the stoutest and longest; the setaceous points are finely spined.

The brachypterous male has a fusiform and shining abdomen, ending in a black cauda, which appears in the centre of a notch. The elytra are about two-thirds the length of the abdomen. Details of the genitalia are on the above plates.

The female is larger and paler in colour, some being ochreous-yellow, and others of an olive-greenish tint, with an obscure bar across the somewhat corrugated elytra.

The above descriptions more particularly apply to common forms of this insect. As to the three last synonyms of my list I would note that Mr. Douglas's cabinet contains a specimen labelled *Acocephalus polystolus*, Fieb., from which my figure is drawn. It measures 0·15 inch, which is rather smaller than the brachypterous male above described. Mr. Edwards, with some reserve, places this and the two previous names in his synonymy under the head of *A. albifrons*. He remarks that both sexes of *A. polystolus* of Scott are one-third larger than *albifrons*, and that they occur under *Obione portulacoides* in salt marshes. He inclines to the belief that *polystolus* is a separate species. Of this I am unable, from want of material, to form an independent opinion.

Mr. Douglas's insect appears to be too small.

Dr. Signoret treats *A. polystolus* as a variety,—amongst others, for "cette espèce peut varier a l'infini." More importance must be given, he says, to form than to colour, and attention is called to the last ventral segment, which approaches the form of *A. nervosus*. His beautiful copper-plate representations of *A. albifrons* do not very well represent the markings of our British insects. As to some of these foreign varieties, the above-named 'Essai' should be consulted (p. 76).

A. albifrons may be taken in many places and on many plants. In June I found them very common on strawberry plants at St. Alban's. I have also specimens from Cornwood, near Plymouth, and from Haslemere hiding under chestnut copses.

Size, 0·11 to 0·16 inch, or 3·0 to 4·0 millimètres.

Var. β, Plate XLI., fig. 2 *a*. — Amongst numerous examples of *A. albifrons* I possess, I figure a small female insect the exact species of which is not clear to me. In some respects it shows affinities with the next species, *A. histrionicus*, whilst in others it partakes of the strong markings shown in Signoret's figures of *A. albifrons*. The multiplication of species without sufficient proof is a great evil; and some of the work incumbent on the biologist is to review lists of names which have been temporarily given, by way of identifying certain variations. When the chief characters consist only of colour and size, it may be well to place isolated examples under the synonymy of the species of greatest resemblance. I have done this in the present instance; although I am not sure that the insect under discussion should not be isolated from it. The membrane of the elytron is much corrugated, and four large white costal spots, with two smaller apical spots, make the insect unlike the ordinary females of either *albifrons* or *histrionicus*. This insect, indeed, has a considerable resemblance to *Philænus exclamationis*, with which genus, however, it has nothing to do. Possibly the black bands have so encroached on the

white elytral membrane, as to leave little more visible than these four white spots on a dark brown ground.

It may, perhaps, come under Mr. Edwards's var. *a*, p. 22 of his Synopsis.

ACOCEPHALUS HISTRIONICUS, *Fab.* Plate XL., fig. 4, and Plate XLI., fig. 2 to 2 *b*.

Cercopis histrionicus, Fab.
Acocephalus histrionicus, Flor; Marsh.; Kirschb.; Sahlb.; Sign., Ess. Jass. p. 84, pl. ii. fig. 16; Edw. pt. ii. p. 23.
Acocephalus arenicola, Marsh.
,, *costatus*, Walk.

Male. General colour, yellow. Head obtusely pointed. Vertex longitudinally striated, and shorter than the pronotum and the scutellum taken together. Ocelli nearer the eyes than the vertical apex. A brown irregular stripe occurs before the faintly carinated vertex, which also shows a straighter stripe below. Scutellum black, trimaculate with yellow. Elytra yellowish, hyaline, with an indistinct brown venation. A straight brown band crosses them near their apices, which is best seen when the wings are closed. Abdomen black, with yellow borders. Genital plates acuminate, black, pubescent, and three times longer than broad (Sign.).

Size, 0·13 inch, or 4·0 millimètres.

Female. Larger than the male, with the vertex longer. Pronotum transversely striated. General colour dirty olive-green or ashy-grey. Scutellum shorter than the pronotum. Elytra membranous, finely corrugated, and obscurely banded with brown. Wings ashy-grey. Pygofer notched, enclosing a small cauda.

Size, 0·16 inch, or 4·5 millimètres.

This is a well-marked species, but not common in Britain, where it is found on sandy coasts. Taken also

at Haslemere. It occurs in Sweden, Finland, France, and Austria.

ACOCEPHALUS FLAVOSTRIATUS, *Donovan.* Plate XLI., figs. 3, 3 *a.*

Cicada flavostriata, Don., Brit. Ins. viii. pl. 288, fig. 2.
Jassus rivularis, Germ.
Aphrodes rivularis, Curt.
Acocephalus rivularis, Flor; Marsh.; Sahl.
Anoscopus histrionicus, Kirschb.
Acocephalus flavostriatus, Scott; Edw. pt ii. p. 24.
,, *flavostrigatus*, Sign. (throughout), pt. 2, fig. 17.

Male. Form subovate. Colour ochreous-yellow, with brown markings; or otherwise brown, with yellow markings. Point of the vertex with a brown tridental mark, and three toothed marks at its base. A triangular band across also the pronotum. Scutellum dark brown, with yellow variegations. Elytra short and obtuse, with six or seven diagonal and nearly parallel brown bands, which cause the yellow nervures to appear very broad and marked. Legs ochreous; hind tibiæ dilated, and streaked with a longitudinal brown line. Eyes grey. A black spot on the disc of the frons, and two small ones above.

Female larger and more ovate. Head and thorax much mottled and variegated with brown. Elytra fulvous-yellow, with all the membrane between the nervures dark brown. Genital valves nearly twice as long as the navicular valve.

Common on most damp soils. Widely spread all over Europe. Poland, Sweden, and France.

The males of this species have a considerable resemblance to *A. histrionicus*, but the females are unlike that species in several particulars.

	Inch.	Millimètres.
Size of male	0·12	3·00
,, of female	0·16	3·7

ACOCEPHALUS BRUNNEO-BIFASCIATUS, *Geoff.* Plate XL., figs. 2 to 2*b*.

Cicada brunneo-bifasciata, Geoff. *C. serratulæ*, Fab.
Jassus serratulæ, H.-Schff.
Acocephalus serratulæ, Kirschb.
Anoscopus brunneo-bifasciatus, Sign., Ess. Jass. p. 82, pl. i. fig. 15.

Male. Head, thorax, and scutellum honey-yellow, and almost immaculate. Elytra shining white, marked with three black, irregular, incomplete and disjointed fasciæ. The middle fascia suffused with warm sienna-brown. Sometimes the scutellum is punctured with black. Vertex somewhat convex, with a faint medial furrow.

Signoret says the insect may be distinguished by the non-dentate and convex head of the male, and by the presence of the above medial line.

The female is described as pale yellow, more or less mottled on the vertex. Elytra finely punctured, with small black points on the suture. Not uncommon at St. Alban's, where it infested the strawberry plants. June.

Size, 0·16 inch, or 4·0 millimètres.

N.B.—The appearance of this insect is so very like that of *A. albifrons* that its distinctive character (chiefly consisting of colour) may be thought hardly sufficient for separation.

ACOCEPHALUS BIFASCIATUS, *Curt.* Plate XL., fig. 5.
Curt.; Flor; Marsh.; Kirschb.; Sahlb.; Edw. pt. ii. p. 20; Sign. p. 66, pt. 1, fig. 8.

The synonyms of this species are numerous and sufficiently intricate. Dr. Signoret's Essay may be consulted for a full list, amongst which may be mentioned:—

Acocephalus trifasciatus, Sahl. and Fieb.
,, *dispar* and *nigrilis*, Kirschb.
,, *tricinctus*, Curt. *A. interruptus*, Fieb.
Jassus subrusticus, Germ.
Penthotænia, Amyot; Flor.

Male. Ochreous-yellow or red-brown. Vertex serrated in front, and less acuminate than in the foregoing species. Vertex mottled with brown. Pronotum yellow. Elytra finely punctured, and marked with two distinct fascia and a broken indication of a third across the shoulders. The characters of these fasciæ determine, in great measure, the names of the above synonyms. Legs ochreous, with the hind tibiæ and tarsi dark brown. Abdomen black.

Female. Oblong. Vertex rounded. Colour yellowish, passing into a greyer tone. Costa of the elytra with marked brown spots. The whole upper side of the insect more or less coarsely stippled with brown.

My figure and the descriptions are taken from specimens named by Mr. Douglas. It will be seen from the above that the males are exceedingly like some of the varieties of *albifrons*.

Size, 0·18 inch, or 4·7 millimètres.

Signoret gives Europe and Edwards the north of England as habitats. Not common.

There is cause for regret that three species of *Acocephalus* should have such like names as *A. bifasciatus*, *A. brunneo-bifasciatus*, and *A. trifasciatus*.

Acocephalus nervosus, *Schrank*. Plate XLI., figs. 4 to 4 *a*, and Plate XLII., figs. 2 and 3.

Cicada nervosa, Schrank.
Acocephalus cardui, *obscurus*, *sparsus*, *unicolor*, *fasciatus*, *pallidus* and *bicinctus* of Curtis ; *adustus* of Hardy.
Acocephalus rusticus, Flor ; Marsh. ; Kirschb. ; Sahlb. ; Sign., Ess. Jass. pl. i. fig. 6, p. 62 ; Edw. pt. ii. p. 19.

This large and common species has an extensive synonymy, only a part of which is to be found in the above list.

The variations in size are as remarkable as those of colour. Some specimens are almost uniformly ochreous in colour, whilst others are dark brown or nearly black. Some are yellow, with a single fine band of umber-brown across the bases of the elytra, whilst others have the head and pronotum ochreous, and the elytra profusely spotted and mottled with black, grey patches appearing on the corium and the costal edges. A rather common variety is of a ferruginous-brown, with black eyes and mottled elytra.

The varying flatness of the vertex, with its deep depressions and marked frontal carina, is observable ; as also is the more or less produced acute form of the head itself.

Male. Head roughly punctured. Vertical carina usually very marked. Pronotum rugose and a little longer than the head. Scutellum rather small. Elytra rough ; nervures pale and raised. Abdomen black. Genital plates yellow, long, straight, and obtusely pointed. The groove deep. Hypopygium longer than broad (sometimes shorter), pubescent. The anal style or cauda scarcely visible.

Female. Greenish or dirty yellow ; usually speckled with brown or with paler spots.

Signoret describes the apical border of the last ventral segment nearly straight, with the angles notched (*arrondis*), more or less sinuous at the sides, forming as it were two large lobes with a separating notch. He remarks that, by proper attention to the variation in the forms of the sexual organs of the Acocephalidæ, we may correlate the sexes, notwithstanding the discrepancies they show as to the straight or convex forms of the sides of their heads.

In a general manner we may group varieties thus :—

Frontal bands one on the vertex and one on the pronotum. *A. transversus*, Fabr.

Elytra brown, with pale nervures. *A. striatellus*, Fabr.

Elytra yellow, and punctured with brown on the claval nervures. *A. costatus*, Panz.

Mr. Edwards, in August, 1883, discovered in the salt marshes at Wells, Norfolk, a remarkable race of this species, in which the males were pale yellow-brown with a greenish tinge, "finely irrorated with fuscous," and with the crown decidedly sublunate. The females, however, seem to have been of the normal forms.

I have received some finely marked and large specimens from the Rev. A. Brenan, who captured them. These with other species were kindly forwarded to me from Cushenden, County Antrim, Ireland. The vertices of these insects are much extended, even sufficiently so to recall the forms of *Eupelix*.

The figures in my plate show the extreme variation in colour, except that some examples are even darker than those shown on fig. 4 of my plate.

Common everywhere in England, Ireland, Europe, and Algeria.

Size, with elytra, 0·20 to 0·31 inch, or 5·0 to 8·0 millimètres.

Mr. Douglas possesses a British specimen labelled,

by Dr. Signoret, *A. carinatus*, the true naming of which Mr. Edwards doubts. The real *carinatus* should have the vertex in both sexes tricarinate.

Genus XXX.—PLATYMETOPIUS, *Burm.*

Body oblong. Head with the eyes a little narrower than the pronotum. Vertex produced into a more or less acute angle, and forming a carina with its reflexed apex. Elytra ample, with two, or sometimes three, extra transverse nervures dividing the ante-apical areas. Limbus narrow. Wings obscurely clouded, and veined like the Jassidæ. The vertex is more strongly ridged in the male.

Only one British species has yet been described.

Platymetopius undatus, *DeGeer*. Plate XLII., figs. 1 to 3.

Cicada undata, De Geer, Abh. Gesch. Ins. iii. t. 1, fig. 24.
Platymetopius undatus, Flor; Kirschb.; Fieb., S. D. fig. 64; Thoms.; Sahlb.; Scott; Edw. pt. i. p. 26.

Colour rich yellow. (" Oblongus, saturate flavus." Sahlb.) Vertex in the male longer than in the female. Eyes yellow and bordered with brown. Central portion of the vertex and of the pronotum rich brown, the latter slightly striated. Abdomen black, edged with yellow, and showing a yellow curved streak below the scutellum. The last ventral rings yellow above. Elytra yellow, unequally and broadly banded with brown at their apices and at their basal edges. When closed, this wavy band forms a conspicuous feature of the insect, and then appears as a kind of double chevron, edged with black, and showing at the suture white spaces near the clavus. The nervures are darker

yellow. Legs pale lemon-yellow, with a yellow ciliation. The two hind tarsal joints of nearly equal length. Claws black. The neuration of the elytron is best shown by the figures 1*e* and 1*f* on Plate XLII. Frons more than twice longer than broad. Clypeus small and ovate. Rostrum short. Last ventral segment in the female one-half longer than the preceding, its hind margin bounded by an angular notch on each side of the saw-case. Valves very long. Genitalia of the male complex.

The figures of the pygofer on my plate do not well agree with the small outlines given on Fieber's plate.

Hitherto this pretty species has been rarely taken in England. Scott captured it in 1882. Mr. C. Bignell obtained it in July, 1887, by beating some hedge bushes in Coonwood, South Devon, and at Cann Quarry, Bickleigh, on *Pteris aquilina*. Subsequently Mr. A. Piffard kindly gave me specimens which he obtained from some oaks in Brickett Wood, Hertfordshire. Though somewhat rare, this insect is extensively diffused, occurring as far north as Christiania, in Norway, over most parts of Europe, and, according to Sahlberg, also in N. America.

	Inch.	Millimètres.
Expanse of wing	0·39	10·0
Size of body, with elytra	0·24	6·00

Mr. Charles Bignell informs me that he was collecting Ichneumonidæ with Scott, when he drew attention to this handsome insect seated on the top of some bracken. Shortly after, in making a search over the fronds of the fern, he captured a second example; and then he had no trouble in taking as many examples on *Pteris aquilina* as he required.

Platymetopius guttatus is known in Sweden, and there seems to be no reason why it may not also occur in Britain. It may be recognised by the upper side being marked with a number of small dots, and with about forty of the same spots scattered on the elytra.

Genus XXXI.—GRAPHOCRÆRUS,* *Thomson.*
Plate XLIII., figs. 1 to 1 *b.*

Cicada ventralis, Fall.
Athysanus ventralis, Flor; Kirschb.
Graphocrærus ventralis, Thomson, Opusc. Ent.; Sahlb.; Scott; Edw. pl. III., fig. 2, p. 27.

Vertex subangularly produced, and impressed behind its reflexed apex. Ocelli very small and placed on the vertical edge, rather less than half-way between the eyes and the vertical point. General colour of the insect ochreous-yellow, with three or more minute black spots on the sides of the pronotum, and accompanied by a few ferruginous stains, which also may be traced on the scutellum. Abdomen oblong and fusiform, barred transversely with pale brown, and marked with a few dorsal perpendicular streaks. The abdomen separated from the prosternum by a ridge. Legs ochreous; the hind tibiæ with minute dots, from which the setæ spring. Elytra in the females shorter than the abdomen, but in the males rather longer. Venation obscure; but Sahlberg gives the tegmina as slightly rounded, finely rugose, nervures raised, apical areas short, and the intermediate area subquadrate. Frons ochreous, with four spots in a straight line between the eyes, and two brown lines converging to the clypeus.

The above description is from the only specimen I have seen,—a female,—and this named by Mr. Douglas.

Male genital valve rather shorter than the last ventral plate. Pygofer (hypopygium) deeply sinuate behind, with short lateral lobes. The saw-case of the female free to the base, and hardly exserted beyond the abdominal apex.

This is far from a common insect. Its recorded habitats are Weybridge and Lee; also Abbey Wood,

* From Γραφω and κραιρα, inscribed head.

Norfolk; with times of appearance, July and August. Sahlberg states, however, its occurrence over the greater part of Europe, and, from the number of varieties he notes, it probably is not uncommon in Scandinavia.

Size, 0·22 to 0·27 inch, or 5·5 inch to 6·0 millimètres.

Genus XXXII.—DORATURA,* *Sahlb.* Plate XLIII., figs. 2 to 2*d*.

Doratura stylata, Boh.
Athysanus stylatus, Boh.; Kirschb.; Flor.
Jassus stylatus, Thoms.
Doratura stylata, Sahlb.; Scott; Edw. pt. ii. p. 28.

Brachelytrous female. Silver-grey. Head obtusely or almost roundly produced. Carina not visible. Three black spots on the vertical apex, the middle spot the largest. Vertex shorter than the pronotum. Eyes prominent. Pronotum and scutellum yellow, with whitish or greyish streaks and spots. Abdomen large and tapering to a bluntish point, ending with two long genital valves, from which the saw-case much protrudes. The pygofer is about three times longer than the genital plate above it. This style-like organ furnishes the specific name of the insect. Frons broad between the eyes, with a dark wave-like streak connecting the same, and two spots below. Rostrum very short. Clypeus small and ovate. Antennæ fixed within deep fossæ. Each segment on the under-side of the abdomen is ornamented with a crescentic spot. Legs yellow, with pale ciliations. Some specimens show a dark inner stripe on the hind tibiæ.

Brachelytrous male is much of the same colour as the female, but brighter. The vertex is redder, and the elytra are iridescent, as if burnished with gold.

* From δορυ, δορατος, a lance.

Minute dots mark the terminations of the short nervures. The abdomen ovate, and showing distinctly six rings below the tips of the elytra, although eight may be counted on the under-side. The point of abdomen blunt, and ending with two short rounded and flat plates, which enclose the genitalia. Each ring of the abdomen is furnished with a black dash on each side, and numerous punctuations. In the female a triangular spot appears on the sixth ring, followed by a black line, which is continued down the saw-case.

Macropterous female. The rare macropterous male I have never seen; but, through the courtesy of Mr. A. Piffard, I am able to describe the equally rarely-met-with macropterous female, a single specimen of which was taken by him on the hills near Tring, in Hertfordshire:—

Vertex less than one-third of the pronotum and scutellum taken together. Two sinuous brown lines run to the eyes below the apical spots. Eyes yellow, with brown borders. A broad T-shaped band occurs at the base of the pronotum. Elytra large, ochreous-yellow, with an ill-defined brown fascia across the upper parts. Nervures indistinct, but the inner membranes of the areas fuscous. Style long, black, and fringed, projecting much beyond the apices of the elytra. Hind tibia densely fringed on the outer side, and marked on the inner side by a longitudinal black line.

Some of the brachelytrous males are bright yellow, with copper-coloured brownish elytra and finely punctate bodies.

Some years numerous at Weycombe, Haslemere, during July and August. Common also on many coast-sands and on dry heaths, Pitlochry. Mr. Edwards notes a pale-coloured race of this species, about one-half larger than the ordinary form.

	Inch.	Millimètres.
Brachypterous female	0·10 to 0·15	2·70 to 4·00
Macropterous female	0·16	4·50

Genus XXXIII.—PARAMESUS,* *Fieb.*

Vertex subangularly and slightly produced. Head separated from the pronotum by a distinct carina. Frons flat, finely punctured and striated. Ocelli placed at the extremities of a deep brown notch on the front of the head. Elytron usually furnished with two basal transverse nervures, and with no limbus or flap. Length equal to, or rather exceeding, that of the abdomen. The neuration subject to variation. Wings like those of the Jassidæ.

Paramesus nervosus, *Fall.* Plate XLIV., figs. 1 to 1 *d*.

Cicada nervosa, Fall.
Athysanus obtusifrons, Stål.
Paramesus obtusifrons, Fieb. *P. nervosus*, Sahlb.
Jassus nervosus, Thoms.
Athysanus Verralli, Scott. *A. nervosus*, Scott.
Paramesus nervosus, Edw. pt. ii. p. 30, pl. III.

Oblong. Ochreous-yellow or ferruginous-yellow. Vertex obtusely pointed, with two or three brownish streaks towards the pronotum, which last has a triangular discal stain, faintly marked by striæ. Scutellum black. Elytra nearly as long as the apex of the abdomen; nervures pale and strongly contrasting with the membranal areas, they being clouded with dark brown. Apical cells five, or sometimes six. Discoidal cells three, with two or even more transverse nervures. Cubital and subcubital cells also with two transverse nervures. Frons yellow, cordate, narrow near the clypeus, and striated with brown. Clypeus oblong, with a black central line. Gulæ rounded. Loræ, each with a strong brown line below the antennal insertions. Eyes yellow, and marked with brown pigment. Hind legs yellow, and commonly furnished with black points.

* From Παραμεσος, near the middle.

Abdomen black. Point of the pygofer projecting, and coarsely ciliated.

Female. Coloured much like the male, but the neuration of the elytra is less distinctly marked out by the fuscous borderings. The last ventral segment but little longer than the penultimate. The lateral valves setose.

Often abundant in the salt marshes near Romney, and in other places. Hunstanton, Norfolk.

Size, 0·23 inch, or 6·5 millimètres.

PARAMESUS PHRAGMITIS, *Boh.* Plate XLIV., figs. 3 to 3 *c*.

Thamnotettix phragmitis, Boh.; Kirschb.
Jassus phragmitis, Thoms.
Deltocephalus phragmitis, Fieb., Syn. Ent. Delto. fig. 2.
Paramesus phragmitis, Sahlb.; Edw. pt. ii. p. 30.

Form somewhat linear. Vertex somewhat more acute than in the last species. General colour ashy-ochreous. Vertex grey on the apex, and stained with ferruginous-red on the base. A fine line runs down the middle, and two brown dots mark the vertex at the base. Pronotum ashy-grey. Scutellum stained with red and rust-coloured spots. Elytra distinctly longer than the abdomen; with nervures broad, and yellow to the naked eye,—an appearance caused by fuscous-brown markings and edgings to the elytral cellules. This marking gives the insect a kind of brocaded ornamentation. Abdomen black, with pale edges, and striped with black on the under-side.

A single specimen was captured by me in late summer on some rushy ground at Weycombe. This specimen was identified by Mr. Edwards, who subsequently presented me with another example; taken I believe by him on rushes at Romney, in Kent. These are the first recorded appearances of the insect in Britain.

It feeds on *Phragmitis communis*, and is found in parts of Finland during the months from July to October.

Size, 0·18 inch, or 4·5 millimètres.

GENUS XXXIV.—GLYPTOCEPHALUS,* *Kirschb.*
Plate XLIII., figs. 3 to 3*d*.

Only one species has been identified in Britain :—

GLYPTOCEPHALUS PROCEPS, *Kirschb.*

Athysanus proceps, Kirschb.
,, *canescens*, Scott,
Glyptocephalus canescens and *proceps*, Edw. pt. ii. p. 31.

Colour very pale yellow. Vertex with a fine line running from each eye parallel to the frontal apex, and a broader line from the apex to the margin of the pronotum. Two lower spots mark the seats of shallow depressions. Pronotum sublunate and finely striated. A large spot on the disc, with three smaller spots surrounding the same. Scutellum irregularly marked with brown. Legs stout, with strong setæ springing from black dots on the hind tibiæ. Three or more acuminate spots on the dorsum. Abdomen ending with two genital valves, furnished with strong bristles. Elytra white, with a hoary appearance, which is most perceptible during life.

In some specimens the elytra are nearly immaculate, but in others fuscous bands or stripes occur on the areas. The elytra of the females are shorter than the abdomen ; those of the males are nearly equal to the same, and are blotched with brown oblong dashes.

This rarely met species is found on several grasses. I have specimens taken at Brockenhurst, in the New Forest, and others taken at Hunstanton, Norfolk, in July.

Size, 0·20 inch, or 5·00 millimètres.

* From Γλυπτος and κεφαλη, carved head.

JASSINÆ.

Genus XXXV.—STICTOCORIS,* *Thoms.*

Head with the eyes wider than the pronotum. Vertex obtuse. Frons longer than wide. Rostrum stout. Elytra as long or longer than the abdomen. Apical cells five. Discoidal cells two.

Stictocoris Preyssleri, *H.-Schff.* Plate XLIV., figs. 2 to 2*b*.

Jassus Preyssleri, H.-Schäff.; Flor; Kirschb.; Thoms.
Thamnotettix adumbrata, Boh.
,, *Preyssleri*, Scott; Fieb., Cic. Ent.
Stictocoris Preyssleri, Sahlb.; Edw. pt. ii. p. 34.

Colour more or less cinereous-grey, with yellow stainings. Vertex subangular, ochreous, with three black spots near the apical border, and a square spot near its base. Head with the eyes broader than the pronotum. Eyes spotted. Ocelli not visible. Pronotum with a broad central brown line, which passes through the scutellum, and with a spot on each side of the same. Elytron longer than the abdomen, the greater part grey and shining, but passing into ochreous at the costa and the apex. Mostly there is visible a broad parallel bar in the centre. Apical cells five, and discoidal cells two. The limbus is almost imperceptible. Wings with two short transverse veins. Legs yellow; the hind tibia with a black inner stripe. The first tarsal joint the longest, and fringed at the extremity with ciliæ. Pulvilli large. Frons yellow, with a central brown stain. Gulæ and tempora each with a brown spot contiguous to the frons. Pygofer of the male cleft, with two broad genital valves, which

* From Στυκτος, punctured.

are seen best in profile. Abdomen black above, with yellow sides. Beneath yellow, with a central black stripe.

Size, 0·12 to 0·14 inch, or 3·00 to 3·50 millimètres.

Several specimens of this insect, hitherto rare in England, were obligingly sent to me by Dr. A. Piffard, who captured them at Brickett Wood, Hertfordshire, in August, on *Genista anglica*. Taken also at Cisbury, and in Arundel Park, resting on the common burnet. Also found on the hills round Tring.

Sahlberg describes four species as indigenous to Sweden. Fieber included all these insects under the genus *Thamnotettix*.

Genus XXXVI.—ATHYSANUS,* *Burm.*

Body robust. Head obtuse in front. Clypeus wide. Gulæ broad, reaching to the base of the clypeus. Frons three times broader at the summit than at its base. Pronotum anteriorly semicircular. Elytra with at least five apical cells. Limbus very small or none at all. Legs quadra-prismatic, each edge furnished with setæ.

The genus *Athysanus*, as described by Burmeister and by Fieber, does not furnish very sharp characters for separation from *Deltocephalus* and its near allies. Stress has been laid on the straight inferior edge of the elytron; but this character is governed by the fact of the presence or absence of the appendix or limbal flap, such as will form an effective closure to the elytra on the insect's back, and show it to be more than a mere thickened rim to the margin. Restricting the genus to such as have no such protective and true limbus, the nine British examples may be described as follows.

Dr. John Sahlberg, in 1871, described no less than sixteen species of Scandinavian Tettigidæ belonging to

* From α and θυσανος, fringeless.

the genus *Athysanus*. He lays stress on the number of the setæ placed on the fore legs, and the differences of the length and breadth of the vertex as measured against the pronotum. Neither of these characters are easily determined, except when the insect is fresh or has been but recently killed. However this may be, it can scarcely be shown that Great Britain as yet has furnished us with more than half the above number. Still it must be admitted that, so far as colour and marking are concerned, there is a considerable diversity, and, perhaps, in the judgment of some, the reduction of the above number has been carried too far.

Preliminary Synopsis.

The general appearance of the elytra may be taken as an assistance to the preliminary sorting of the foregoing species :—

Elytra very short	*Athysanus brevipennis.*
Elytra pale	*A. grisescens*, *A. sordidus*, *A. obsoletus*, *A. melanopsis*.
Elytra spotted	*A. communis*, *A. obscurellus*, *A. obsoletus* (var. *piceus*).
Elytra with bordered cellules	*A. russeolus.*
Elytra with nervures much raised	*A. Sahlbergi.*

Athysanus grisescens, *Zett.* Plate XLV., figs. 1 to 1 *e*.

Cicada grisescens, Zett.
Jassus grisescens, Flor ; Kirschb. ; Thoms.
Athysanus cognatus, Scott.
,, *validinervis*, Kirschb.
,, *grisescens*, Scott ; Sahlb. ; Edw. pt. ii. p. 38.

General colour pale yellow. Length of the vertex nearly as great as that between the eyes. A dark,

decided, angular black line closely borders the apex, and sometimes there is a paler line near the base. Eyes red. Pronotum with four or five brown streaks, which sometimes unite into a single stain. Scutellum an equilateral triangle, with the scull-like marking so commonly seen in *Idiocerus* and some former genera. Abdomen yellow, with faint brown bars; each segment with a triangular dorsal mark. Pygofer of the male with two large genital valves, forming a notch, furnished with strong bristles, and a conical cauda. Elytron rounded at the apex, and provided with a faint apical border. Nervures pale and whitish; membrane ochreous or pale brown. Wings short and grey. Legs yellow, with dark tibial and femoral points. The hind tibia with a black inner streak. The outer edge fringed with strong bristles. Some examples have the pronotum prettily mottled with grey, whilst other specimens are nearly all pale yellow. A brachelytrous form occurs, the elytra of which are shorter than the abdomen.

Size, 0·21 inch, or 5·60 millimètres.

Fairly common in many places amongst grasses, from early May to July. Also taken under dead oak-leaves, at Weycombe, May 4th, and at Wakefield in June.

The basal fore tarsal joint is so small that the foot might be called di-merous. The frons is convex, and has seven bars across it.

ATHYSANUS RUSSEOLUS, *Fall.* Plate XLV., fig. 2.

Cicada russeola, Fall.
Jassus russeolus, Thoms.
Athysanus russeolus, Sahlb.; Edw. pt. ii. p. 36.

Colour ferruginous-ochreous yellow. Head obtusely rounded. Two narrow angular lines on the extreme vertex, with two incomplete squarish lines nearer the

base. Eyes brown. Pronotum and scutellum nearly spotless. Elytra ample, with all, or nearly all, the borders of the cellules marked with fuscous-brown, somewhat similar to that seen in *Paramesus*. Apical membrane very narrow. Legs pale, with yellow bristles. Frons with a double stripe, and with curved lines down the sides. The frontal side-sutures black. Abdomen rust-red.

Size, 0·13 inch, or 5·50 millimètres.

My figure is from an insect taken by Mr. Douglas on the Addington Hills. It has since been taken by Mr. Norman at Pitlochry, Perthshire.

Said to inhabit heaths in July and August.

The brachelytrous female has no limbus. The brachelytrous male is unknown.

ATHYSANUS SAHLBERGI, *Reut.* Plate XLV., fig. 3, and Plate XLVI., fig. 5.

Athysanus Sahlbergi, Reut., Medd. Faun.; Flor, Fenn. 1880.
A. æmulans, Sahlb. (♂), and *A. confusus* (♀).

Form more robust, larger, and browner than *Athysanus sordidus*, which it much resembles.

Male. Vertex variegated, with two indistinct rows of brown spots. Length about half that of the pronotum and scutellum taken together. Elytra short, and rounded at their apices; nervures raised above the fuscous membrane. Last abdominal ring obtuse and strongly setose. Valvular plates forming a deep notch, within which the anal process appears something like a truncated cone with a wide, square, opening.

Sahlberg remarks, with reference to *A. æmulans*, Kirschb.:—"Hypopygio fere usque ad basin sinuato; lobis laminis genitalibus brevioribus, postice rotundato obliquatis, ante apicem obtusæ apiculato-productam

rectangulariter excisis. . . . . Extus setosis." A description which is much in accordance with my figures of the pygofer.

Taken at Pitlochry by Mr. Norman. I have several examples labelled by Mr. Edwards from "Stanton-Strawless, August. It inhabits marshy places, and is by no means common. Occasionally it occurs in company with *A. sordidus*.

This insect has a close outward resemblance to *A. obsoletus*, a more common species.

Length, 0·17 to 0·21 inch, or 4·50 to 5·50 millimètres.

ATHYSANUS SORDIDUS, *Zett.* Plate XLVI., figs. 1, 1 *a*.

Cicada sordida, Zett.
Thamnotettix sordidus, Zett.
Jassus sordidus, H.-Schäff.; Flor; Thoms.
Athysanus confusus, Kirschb.
,, *sordidus*, Sahlb.; Scott; Reut.; Flor; Edw. pt. ii. p. 37.

Brachelytrous male. Yellow. Vertex with a grey and rounded apical border, and a length about half that of its width; sparsely spotted with brown. Eyes grey and similarly spotted. Pronotum ovate, with a transverse row of dots and a grey streak below. Scutellum with the normal marks pale. Abdomen black, with the somites edged with yellow. Elytra shorter than the abdomen, semi-transparent, with pale nervures. Cellules fuscous-yellow. Legs yellow, with minute dots on the outer edges, from which the setæ spring. Hind tibiæ each with a black inner streak.

Female. Larger than the male. Honey-yellow and almost without markings, except a few streaks on the pronotum. Apex of the abdomen blunt, furnished with coarse yellow bristles, and a notch within which the base of the black saws protrudes. Elytral nervures pale.

This somewhat common species is very variable as to colour; and this character is shown more particularly in the males.

Widely distributed in Britain, and met with from June to September, over all Sweden and Finland.

Length, from 0·14 to 0·18 inch, or 3·50 to 4·50 millimètres.

ATHYSANUS MELANOPSIS, *Hardy*. Plate XLVI., figs. 2 to 2 *a*.

Aphrodes melanopsis, Hardy, Trans. Tyneside Field Club.
Thamnotettix melanopsis, Scott; Edw. pt. ii. p. 41.
" *Scotti*, Fieb., Cic. d'Eur.

Male. Small, robust, fuscous-yellow. Vertex obtusely angular, about two-thirds the length of the pronotum. Two or more fine, angular, or horse-shoe-shaped lines occupy the crown. Eyes brown. Frons black (whence its name). Pronotum large, striated, and gibbous, with two perpendicular broad lines, and one basal transverse line. Scutellum small. Abdomen black, with a pointed apex, coarsely setose. Elytra about equal to the length of the abdomen; the nervures faintly indicated by brown lines.

Female more oblong. Coloured much like the male. The hind femora very setose, with two black lines near the knees.

The small size (*viz.*, 0·12 inch or 3·0 millimètres), the form of the frons, and the deltoid form of the head, are distinctive. Not common.

Athysanus brevipennis. Plate XLVI., figs. 3 to 3 *c*.

Athysanus brevipennis, Kirschb.; Flor; Sahlb.; Edw. pt. ii. p. 36.
A. depressus, Scott.
Jassus porrectus, Thoms.

Male. Small, oblong, fulvous-yellow. Vertex rather longer than the pronotum, with an interrupted line between the eyes. Pronotum gibbous, and almost spotless. Scutellum small. Abdomen yellow, with sundry obscure brown spots on the somites. Pygofer doubly notched at the apex. Elytra two-thirds only of the length of the abdomen; nervures much raised above the olive-brown coloured membranes. The elytra are much more rudimentary in some examples than in others, and then they are very simple in their neuration. Frons yellow, and barred with brown. Clypeus long-trapezoidal, with a faint enclosed mark. Rostrum small. Basal antennal joint the largest, and swollen.

In fig. 3 *a* the genital plates are probably expanded through pressure. This insect was taken by Mr. Mosley at Huddersfield, in July.

Mr. Douglas's cabinet contains an example which partly differs in form from the above. The head and pronotum are not so broad, the elytra are less rugose, and the legs are spotted with black. The hind tibia has also a black stripe. I figure both these forms.

The macropterous form has not been described.

Length, 0·14 to 0·16 inch, or 3·50 to 4·00 millimètres.

Localities :—Braemar, Pitlochry, Huddersfield, and Haslemere.

ATHYSANUS COMMUNIS, *Sahlb.* Plate XLVII., figs. 1 to 1 *d*.

Athysanus communis, Sahl.; Edw. pt. ii. p. 39.
Jassus plebejus, Flor; Kirschb.
Athysanus plebejus, Kirschb.; Scott.

Large. Shining yellow, sometimes greyish yellow. Vertex rather acute; as long as its base between the eyes; spotted with round brown dots, as also is the pronotum. Eyes grey or reddish. Abdomen black on the dorsum, with the three last somites yellow; the two first somites marked by three dark triangular spots, the last ring with one spot. Apex hirsute. Elytra rounded at their ends, without a limbus, but the periphery much thickened, hyaline, and pale; scantily spotted with brown. Nervures colourless, and much subject to variation. Number of apical cells inconstant. Frons yellow, with two fine longitudinal lines and seven or more fine striations on each side. Gulæ semicircular, and swollen. Legs spotted with black. The hind tibia sometimes has a black inner line.

Length, 0·16 to 2·00 inches, or 4·00 to 5·30 millimètres.

Common in wet places. Taken also on the sea-shore at Romney, Kent.

ATHYSANUS OBSCURELLUS, *Kirschb.* Plate XLVII., figs. 2 to 2 *f*.

Athysanus obscurellus, Kirschb.; Scott; Edw .pt. ii. p. 39.
Acocephalus agrestis, Marsh.

Male. Colour dirty ochreous-brown. Whole insect finely spotted with brown. Vertex in length, two-thirds

of the breadth between the eyes. Eyes large and reddish. Pronotum transversely striated and blotched with brown. Elytra subhyaline, without a limbus, about equal to the length of the body, and with brown nervures; sometimes the membranes much and finely punctured with brown. Apical areas five, sometimes six, in number. Frons nearly all black, with faint dirty yellow striations. Fore legs yellow, with the femora barred with brown. Antenna with the two basal joints large, followed by a very compound seta, made up of numerous tapering joints. Genital valves of the male equilateral. Under-side all black, except the obscure yellowish striations on the frons and parts of the eyes.

The female is much paler than the male in tint.

Not uncommon at Weycombe, Haslemere, and at Huddersfield, mostly found on commons and heaths.

Length, 0·14 inch, or 3·50 millimètres.

Athysanus obsoletus, *Kirschb.* Plate XLVIII., figs. 1 to 1*d*, and Plate XLVI., figs. 2*a* and 6.

Athysanus obsoletus, Kirschb.; Scott; Edw. pt. ii. p. 40.
,, *sexpunctatus*, Sahlb.
,, *piceus*, Scott.

Male. Vertex speckled and marked by six black spots placed in two oblique rows meeting at the apex. Frons yellow, with black striations. Elytra variable as to length, and usually without any indication of the black punctuations, so evident in *obscurellus*. Abdomen black, and often showing the yellow connexivum between the rings.

A. piceus of Scott is a melanic variety of this male. Its general colour is dirty smoky-yellow, which tint is almost obliterated, however, by numerous brown punctures and black blotches. The pronotum is rather

paler than the rest of the body. Legs piceous-black, each with a darker streak on the hind tibia.

Female. General colour greyish-ochreous. Vertex one-half longer in the middle than is the width between the eyes. Yellow, with a fine central line. Pronotum darker grey. Scutellum yellow. Notum and the first four abdominal rings black; the remaining rings yellow, each having a dark dorsal spot. Elytra ochreous or with a reddish tinge, semi-transparent; the nervures indistinct, and indicated by brown streaks. Legs yellow, with the usual dark streak.

Abundant, in long grasses, at Haslemere and most other places. This insect is broad and robust, and in form is not unlike *A. grisescens*.

In the autumn the female may be taken with the greater part of her abdomen occupied by from six to eight long, shuttle-shaped, and curved ova. Later in the year these eggs may be seen charged with yolk granules, and at one of their ends the large germinal spots may be observed undergoing the process of segmentation. At such times—if the male insect be placed under a drop of syrup, and gentle pressure be applied—two thin-walled vessels (collaterial ?), together with a curved penis, may be extruded, and the short styles also may be thus exhibited under the microscope.

Length, 0·17 to 0·22 inch or 4·50 to 5·50 millimètres.

The following Table is not drawn up to supersede the diagnosis of the species, but to assist in a first general grouping of the section :—

SYNOPTIC TABLE.

Acocephalinæ.	Vertex striated.	Pronotum striated.	Elytra banded.	Nervures in strong relief.	Transverse veins in elytra.	Presence of a limbus.	Apical areas in elytra.	Genital valves.
Eupelix . . .	—		—		*	—	5 ?	
Platymetopius .	—		+		2-3	small	5-6	2-3
Strongylocephalus	+	+	—		2		5	+
Acocephalus . .	+		+	+		+		
Doratura . . .	—		—					
Graphocrærus .	—		—		1			+
Glyptocephalus .	+	+	—		1	small		
Paramesus . .	+	+	—	+	2	+ —	5-6	
Athysanus . .	—	+	+ or —		1	+ —	5-6	

N.B. + is equivalent to present; — to absent. If there be no mark it may mean absent, doubtful, or else not observed.

PARASITES OF THE TETTIGIDÆ.

Professor Pritchard tells us, with a good deal of truth, that a large part of our pleasure connected with exact knowledge, consists in the bye-paths (*parerga*) which run more or less collaterally with our main investigations. Early writers occasionally introduced into their more special and grave matter paragraphs which they called "Excursus." The kind-hearted veteran zoologist, William Yarrell, expressed to the author the belief that the interest taken by the general public in his scientific works was in great measure due to the introduction of collateral matter, perhaps not strictly in sequence with his diagnoses of species.

Playfulness and clearness of style is not what the present author lays any claim to; and probably he may, after all, fail therefore to clothe, what some may think, the bare bones of science, in an alluring garb. Still, under such an excuse, the present chapter on Parasitism connected with the Cicadæ is introduced to the reader, though not in strict sequence with the diagnoses.

Like other insects, the Tettigidæ are liable to the attacks of parasites, both vegetable and animal; but only a few species up to the present time have been specifically noted.

In this Monograph some brief and general account of their occurrence and habits may be expected, as these pests—from the insect point of view—must have some important bearings on the economy of their hosts, and check their undue multiplication.

Kearsley, as far back as the year 1802, published a short notice of a singular fungoid growth on one of

the American Cicadæ.* M. Fourgeau, however, before this time, had described the same or a like growth as a remarkable instance of a reverse action,—namely, that of a vegetable feeding on an animal. The name *Clavaria* was then given to this "animal-plant," on account of the branching stalks of the fungus, which are terminated by tuberculous masses, having the appearance of little clubs. The root of this plant is described as chiefly covering the skin of the body of the insect, and extending partly over the region of the head. This parasitic growth was found chiefly to attack the chrysalides of Cicadæ.

Dr. Hills, of Martinique, subsequently stated that the Cicadæ of that island are subject to a similar attack of vegetable parasitism.

After digestion in spirits of wine the plant could be separated from the insect, without injury to either itself or its host.

Prof. Charles Riley, in his researches in the history of the American *Cicada septendecem*, remarks that if the winged insects be accidentally and extensively mutilated, yet not killed; a species of fungus fixes itself on the living bodies, and burrows amongst the soft tissues in such a manner as speedily to convert them into a mass of spore-like powder, resulting in the entire death of the insect.

M. Pasteur's classical investigations on the nature of pibrine and muscardine are fresh in the memories of most readers. In these 'Mémoires' he shows how the silk-cultivator may shield himself from immense loss, by taking due precautions against the attacks of fungoid growths, which seem somewhat analogous to those above noted in the Cicadæ.

With reference to the insect foes of the Tettigidæ we may take first in order the simpler organised group of the Acarina. Only a brief notice, however, can be given in this place of an interesting subject.

* See Kearsley on Cicada, 'English Cyclopædia,' London, 1802.

Of the few known species which infest the British Cicadæ, the larval forms of the Trombidiidæ are the most numerous. This Acarine group has representatives which show either predatory or parasitic habits on many insects. Even man himself is not exempt from such attacks, as is exemplified in the harvest-bug, or *Leptus autumnalis* of early authors.

I have the kind permission of Mr. Albert Michael to use some valuable information he gave me on submitting to him a few drawings and preparations relating to the Acarine species which infest the Delphacidæ and Deltocephali treated of in this Monograph.

The parasitic habits of these minute Acari have been long known, but it was not at first understood that these hexapod forms were all larvæ. They were supposed to be adults, and that each species thus represented was imagined to have one host, and one host only.

Thus, though De Geer evidently considered correctly that many hexapod mites were the young of octopod species, yet he established the different species *Acarus phalangii*, *A. libellulæ*, *A. culicis*, and *A. aphidis*, all of which are really hexapod larvæ, and "probably some or all of them are identical with each other."

The *Acarus cicadarum* of Goetz is another instance of the same mistake.*

Scopoli and Hermann also supported the same view, and, again, Latreille erected the genera *Leptus* and *Caris* for the hexapod mites, thus perpetuating the same error.

On the other hand, M. Antoine Dugés showed that the above hexapod, *Acarus phalangii* (the red mite that attacks the well-known long-legged harvest spider), was the larva of an octopod *Trombidium*. But even he supposed the octopod pupa or nymph to be the adult.

Of late years the subject has been investigated by M. P. Mégnin, who has traced the life-history in the cases of *Trombidium fuliginosum* and *T. holosericeum*,

* 'Beschaft. d. Berlin. Gesell. Naturforsch. Freunde,' Bd. II. taf. viii. figs. 1, 2, 1776.

and he has given excellent drawings, including the mouth organs of the larvæ.*

Mr. Albert Michael, the accomplished author of the 'British Oribatidæ,' remarks that the Trombiidæ are strictly predatory in the adult stage, but that they have larvæ which—although not truly parasitic any more than the gnat or leech—will yet attach themselves to the bodies of insects, or even of mammals, and are usually separated from their hosts only by death or by artificial means. These pests, burrowing into the skins of warm-blooded animals, cause intense irritation, and in hot countries they sometimes set up dangerous inflammation. The harvest bug, or *rouget* of the French, is here a familiar example.†

The Oribatidæ, or, as they are sometimes called, the "eyeless beetle mites" (although they do not attack beetles), are in no ways predatory like the Trombiidæ.

It is not always the same species which causes such intolerable itching on our legs after walking on the long grass in autumn; but the chief offender is the larva of *Trombidium holosericeum.* It must not be supposed that one species of *Trombidium* is parasitic solely on one species even of insects. On the contrary, the larvæ of several species of *Trombidium* may be found parasitic on the same insect, and the larvæ of one species of *Trombidium* may be seen to attack several insect hosts. "In fact, they may get on to almost any living creature which they can obtain, and which is large enough to carry them about; but doubtless certain animals—such, for instance, as the little crustacean Phalangidæ, or so-called long-legged harvest spiders—are more infested than other small animals."

The adult *Trombidia* are free living; and can exist away from any host, but they certainly attach themselves to some kind of host if they have any chance of so doing.

* "Mêmoire sur les Metamorphoses des Acariens et sur celles des Trombidions," An. Sc. Nat. 6 ser. Zool. t. 4, 1876.

† See "Oribatidæ," Ray Soc. 1883, vol. i. p. 5.

In answer to my query Mr. A. Michael states—"It is a fact, that all adult Acari are octopod, except such creatures as *Phytoptus*, in which some of the legs are abortive."

On Plate XVII., fig. 3 *b*, of this Monograph will be found a drawing of the brachypterous *Liburnia limbata*, with two tick-like sacs attached,—one example is fixed on one of the abdominal rings, and the other on the hind tibia. A microscopic examination of these scarlet-red sacs proved them to be larvæ of *Trombidium fuliginosum*, and that they were attached by certain claw-like processes of the mouth, and perhaps aided in their hold by two soft and fringed oral disks. The efficacy of these claws is increased by the fact that each palpus has its last joint articulate at the base. In Plate D, figs. 10 and 11, I have figured this mite, but unfortunately I have neglected to show in my enlarged drawing this characteristic articulation of the palpus.

This Acarus may be taken on such Cicadæ as *Athysanus communis* and *Deltocephalus ocellaris*, and I have found it fairly common also on some of the Cecidomyidæ, and on Phalangidæ. Such sporadic habits would seem to indicate that this mite is, in a manner, indifferent to its local surroundings.

Another species of *Trombidium*, *T. holosericeum*, likewise attaches itself to the bodies of some of the Acocephalidæ. It also has a bright red body, the head is eyeless, and it has the projecting claw-like process at the end of the palpus. The abdomen, however, has more of a fiddle-like form than *fuliginosum*, and its hard skin is furnished with many short scarlet hairs, which make its integument appear somewhat silky.

On the same plate (D, fig. 12) I have engraved an Acarus of a cycloid form, with six legs, the species of which is as yet undetermined. Its colour is yellowish, with twelve roundish spots on the body-rings, disposed in four rows of three each. This mite infests several species of *Liburnia*, and, like other larvæ of this group, it possesses only six legs.

If an animal is subject to the parasitic attacks of insects, we may pretty confidently conclude that the Hymenopterous order will furnish something in the list. Such an insect has been the particular study of Dr. Josef Mik, of Vienna, who, in 1882, wrote an interesting memoir on the biology of *Gonatopus pilosus* of Thoms., which, in the larval condition, clings to the abdomen or thorax of several Acocephali and Deltocephali. In places where such insects are common, individuals may often be found having a black or brownish excrescence, as large as a millet-seed, generally protruding from the first abdominal ring of their bodies, or adhering very strongly to the pronotum close to the head. If torn away, this body has the form of a hard purse-like sac, without apparent limbs of any kind. Its texture is tough and chitinous, smooth and shining, somewhat pear-shaped, and furnished round one edge with a deep suture (*eingeschobene Schiene*). (See Plate D, fig. 3). There appears to be a faint indication of segmentation into rings, and, at a later stage of development, there are, according to Prof. Mik, obscure rudiments of a head and antennæ.

At first Prof. Mik failed to breed any living forms from these sacs, for the hosts (Cicadæ) soon died in confinement; but subsequently, in early September, he obtained winged specimens of Deltocephali, with these sacs attached, and with these insects he was more fortunate. He found a quantity of prismatic bodies scattered within the substance of these purses, which he thought probably might be compounds of uric salts.

During an examination of these bodies, previously softened by soaking in water, I (the present author) could find nothing within their interior beyond a quantity of undifferentiated semi-fluid matter, but with no defined traces of organised limbs. The exterior case, however, could be partially unravelled by needles into black silk-like fibres, which extended from the back towards the suture. Their general distribution

over the surface gave the appearance of darkish bands, suggesting a segmentation. On account of the distortion produced in the body-ring of the Cicadæ infested, some idea might probably arise that these sacs were merely abnormal expansions of the horny rings; but this can scarcely be the case, on account of the curious fibrous texture above noted, and the fact that, when attached to the neck of the Cicada, a sort of peduncle is seen, communicating with the living juices of the host. (See Plate D, figs. 1 to 4.)

Prof. Mik, in the month of September, planted, in moist earth, living specimens of *Glyceria fluitans*, *Succisa pratensis*, and some kinds of *Carex*. These were all placed under a glass shade, after having introduced upon the plants some specimens of *Deltocephalus zanthoneurus*, which were encumbered with the sacs alluded to. The *Deltocephali* soon began to suck the juices of the *Glyceria*, and, after feeding for twenty-four hours, it was noted that the purse-like bodies had split down their sutures, and that the empty shells gaped open like the valves of a mussel.

On one plant of *Succisa* was found a fat larva, and afterwards two others amongst the flowers, which had evidently escaped from other sacs. The separation from these purse-like bodies was clearly a case of exuviation. Before the disengagement of these larvæ the unfortunate hosts had become transparent from the abstraction of their nutritive juices, and soon afterwards they succumbed.

These parasitic larvæ are yellowish, shining, eyeless maggots, about four millimètres in length, rather broader at their posterior than their anterior extremities; thirteen segments, together with the head, may be counted, each segment carrying one dorsal and two lateral bristles. Prof. Mik, in his memoir, gives a detailed description of the head, the clypeus, labrum, and short antennæ, and he notes a kind of slit which might conceal a sucking organ. Progression is effected, maggot-like, by use of the before-mentioned bristles,

the head being searchingly thrust from side to side. Whilst moving forward a thread is spun upon the track, for a secure attachment of the creature to its support. The larvæ appeared to be searching the earth for a suitable place for their transformation; but eventually one spun, on the inner side of a test-tube, a double, loose, cylindrical cocoon, within which the creature hybernated through several months, in the form of a brown pupa; finally, in the following June, the female of an Hymenopterous, ant-like, insect disengaged itself. This creature proved to be *Gonatopus pilosus*, of Thoms., a description of which may be found in 'Kongl. Vetensk. Akad. Stockholm,' 1860, p. 180.

The exact nature of the above-named sac-like body seems to be still obscure. Is it a true egg, which, by a kind of peduncle, has penetrated the skin of the victim, and, by some unknown action, has caused the juices to intercommunicate for the benefit of the yellow larva, which subsequently hatches within? On the other hand, is there any truth in the idea which has been started by others, that the maggot is a parasite feeding upon a parasite, which has before fed on the Cicada? There seems to be an improbability that the abstraction of nutritive substance, through a tube which might be likened to an umbilicus, could take place in a simple ovum.

Long before the appearance of Prof. Mik's memoir, M. Perris had remarked these purse-like bodies attached to certain Athysanidæ. He placed certain of the latter insects in glass tubes, and subsequently showed to his friend Dufour that a larva had spun a double silken cocoon. From this cocoon he afterwards bred a specimen of *Gonatopus pedestris*, Dalm. He adds, in his memoir, "Cette Hymenotère est il le vrai parasite de l'*Athysanus*, ou bien le parasite de son parasite? Je pencherai pour cette dernière hypothèse, à cause des deux envelopes, très distinctes, que présente le globule noir." —(See Ann. Soc. Linn. Lyon, ser. 2, t. iv., 1857, p, 172.)

Prof. Mik, on the other hand, thinks it more probable that *Gonotopus* is directly parasitic on the Tettigidæ,—an opinion which I am inclined to endorse.*

With all due acknowledgment to Prof. Mik, I have reproduced four figures from his plate relating to the remarkable construction of the fore leg of the apterous female of *Gonatopus*. This peculiar development out of the tarsi, of a prehensile apparatus, only obtains in the female. The contrivance is clearly fitted to secure a hold on the limbs of any unfortunate Cicada which may happen to come within the spring of the *Gonatopus*. The insect in walking does not appear to make use of the tarsus of the fore leg, which is then folded backwards. One of the claws of the tarsus of each front leg is lengthened into a peculiar sword-like process, and the other claw is developed into a flattened spoon-like plate, with two strong teeth, and short bristles like a comb: these parts are so jointed to the foot that they can be closed one upon the other, after the character of a pair of shears or a vice; the insect can thus secure itself firmly to the hairs of any unfortunate Cicada on which it leaps.

There are several species of *Gonatopus* in which the claws are slightly differentiated from the apparatus above described, but they all seem to be predatory upon Cicadæ or small insects of a like kind. On Plate E will be found a drawing of *Gonatopus formicarius*, and also a winged male of the allied form of *Aphelopus*.

Mr. Edward Parfitt, of Exeter, noted a black parasite infesting *Jassus* (*Thamnotettix*) *subfusculus*, and also *Acocephalus* (*Strongylocephalus*) *agrestis*. The latter insect was kept on grasses; when eventually the parasite burst open the black case, which he considered to be the hardened skin of the larva, previously attached to the host. He likewise observed the case to open into two parts, and thus "to allow the pupa to drop

* See Dr. Josef Mik on *Gonatopus pilosus* ('Wiener Entomologische Zeitung,' Wien, 1882).

out." The host soon died from exhaustion. I can find no notice of the species of insect bred from this pupa.—(See Ent. Mo. Mag. vol. xix. p. 117.)

The egg of *Gonatopus* is probably at first glutinous, and, shortly after deposition, a penetration is effected through the soft connexivum between the horny rings of the body, when its contents undergo the change previously noted.

In the 'Trans. Ent. Soc. of London' for 1876 may be found some short notes relating to the parasites of some exotic Fulgoridæ.

Prof. Boheman, some years before, had succeeded in breeding, from the bodies of *Thamnotettix sulphurella*, a minute dipterous insect, *Pipunculus fuscipes*, Fall., and he found that another gnat-like insect also attacks *Limotettix virescens*.

Although much has been written upon the subject of parasitism, it is not at all easy to define any strict natural law through or by which these extraordinary propensities have arisen. As a rule it may be stated that the larger number of Acari are vegetable feeders. Whence comes it, if the original forms had vegetable habits, that the subsequently produced predacious and parasitic kinds should be correlated, not in one but in several of their organs, for such a totally different habit of life?

It is pretty generally admitted that parasitic forms are more or less of a degraded type, and it has been put forward that the abortive organs and members of their bodies have, in a great measure, arisen through some process of deterioration by non-use. It might be anticipated that any animal, seeking its sustenance under any conditions of competition, would be active in habit. with its limbs fitted for searching and obtaining its nourishment. On the other hand, we may conceive that any animal surrounded by its food, where no struggle is required for its acquisition, might undergo abortion and final loss as to certain of its limbs or organs. In some such manner we might think that a

vegetable-feeding mite, on changing its food and general habits, would find its eyes of little or no practical value to itself, and might finally lose them altogether. We see such to be the case in the Trombidiidæ, and also in the eyeless fleas of various bats.

Under somewhat different conditions we likewise adduce the examples of certain eyeless Aphides which live in subterranean ants' nests; and other cases of similar nature will present themselves to ordinary observers.

Useful as this hypothesis may be, as to showing the immediate cause of the degradation of organs by non-use, the explanation nevertheless may prove to be only partially true; for Charles Darwin has told us that the blind beetle, *Bathyscia*, is indifferently the inhabitant of dark caves or of shady rocks quite away from such caves (see 'Origin of Species,' p. 111). The same observer adds that most probably such blind beetles had originally seeing progenitors.

Some surprise may be felt that organs specially fitted for parasitic use are not passed from the larval to the imago state. Should not these conditions, if not further developed, at least show themselves rudimentarily in the adults? On the side of evolution Prof. Claparède considers that the hair-claspers of parasitic mites must have been independently developed, and formed from special modifications of such parts as the legs, the maxillæ, or the palpi of previous species.

After all, we must still speculate on the wherefore, and how, and why, animals should take upon themselves such diverse tastes and diets, as those of vegetable and subsequently of *living* juices of animals.

Mosquitoes, born from larvæ and bred within the Arctic Circle, cannot, one in a million, have the opportunity of tasting the blood of any mammal; yet explorers like Nordenskjold and J. Nansen describe themselves as driven almost to distraction by the thirsty attacks of these creatures. The notice that

fresh blood is near seems to be trumpeted by these insect plagues for miles around.

Where there seems to be so little scope for action, it is puzzling to argue how the correlations of taste, necessary mouth-parts, and accommodating stomach, should rise out of utterly different larval life-conditions by mere natural selection; and why these should only appear in one sex. The probabilities of an unconscious haphazard selection exerted on two—to say nothing of three — simultaneous modifications of organs, perhaps of different physiological systems, yet all in one direction, seem to be very remote. Again, might we not argue, on the contrary, in favour of a loss of parts in blood-sucking animals in the above inhospitable arctic regions, simply from the constrained conditions of disuse? Yet the mosquito is an adept at its work, with no inherited education to help the gratification of its sanguinary tastes.

Previously to resuming the Diagnoses of the Jassidæ, it may be well to remark that of all the Tettigidæ probably the species comprised under the sub-families Jassides and Typhlocybides are the most difficult to identify. Species to the naked eye, and even when assisted by a lens, often show such similarity that they may be often mistaken. It is only when morphological differences can be proved, such as those to be noted in the details of the pygofer, that definite characters can be found to justify separation, one from the other.

Undue multiplication of species, on trivial grounds, must be regarded as an evil; and perhaps this mistake is on the increase.

Mere staining of the membranes, or body tissues, apart from the deposit of pigment, may be due to climatal causes or to photographic action, and some-

thing also may be due to the character of food assimilated by the larvæ.

The ponderous synonymy attached to many species of insects bears testimony to the efforts made by late authors to consolidate groups, which almost from necessity have at first appeared under provisional names.

I think this will apply particularly to those Hemiptera-Homoptera in which salient morphological details are sometimes absent or with difficulty found.

Where no definite life-history is known, and even the habitat is doubtful, there is nothing but individual opinion to decide on the value of characters; and where little more than a catalogue, British or foreign, is available, it seems justifiable to fuse, perhaps, two or more species into one, although it may require some courage to do so. Still, in the list I purpose to make, I thus venture, but in no way dogmatically; leaving to others to show where excision has been carried too far.

In my opinion John Scott and others have laid too much stress on the slightly altered curves of the edges of the isolated male styles of both Delphacidæ and Deltocephalidæ.

Probably the external apparatus of the reproductive organs of insects are more particularly liable to variation than other parts. The very complex and varied nature of the prehensile and locking action of the male and female parts during coupling, in closely allied species, shows that surroundings have a moulding influence; but until such modification can be shown correlated to other parts, caution must be used, not too hastily to dogmatize.

The recent researches of M. A. Giard seem to show that, through the destructive action of some particular Hymenopterous parasite, a kind of male castration is effected in certain Typhlocybidæ; and that, in and through some obscure process, degenerated or degraded forms, differing from the original species, may be perpetuated. This remarkable observation will be alluded to further on.

PLATE D.

Fig. 1.—Head of a *Deltocephalus*, with the black shining purse attached, within which is formed the larva of *Gonatopus pilosus*. Here the sac is seen adhering to the insect close behind the eye.

Fig. 2.—Under side of the abdomen of an *Athysanus*, with a similar sac, showing its attachment between the body-rings of the insect. The suture is turned towards an observer.

Fig. 3.—The sac detached from the insect, with its two valve-like sides.

Fig. 4.—Part of the sac torn asunder, showing at *m* its membranous character, and the singular black fibres which run through its substance, giving it somewhat of a ringed appearance.

Fig. 5.—Representation of the maggot which has been extruded from one of the black sacs, a split being made down the suture.

Fig. 6.—Head and prothoracic ring of the same maggot, much magnified.

Fig. 7.—The imago, having an ant-like appearance, which has been developed from the cocoon spun by the aforesaid larva, and bred in confinement. The singular character of the fore legs, with the remarkable development of their tarsi, is well shown: *p* represents the femur, and *u* the shear-like prehensile organ expanded.

Fig. 8.—A similar insect seen in profile, with three only of the legs and one antenna. The clasping apparatus is marked at *u*.

Fig. 9.—Front leg, with its trochanter, coxa, femur at *p*, tibia at *r*, and first joint of the tarsus at *p*. At *v* the hinge is represented, upon which the sword-like claw, *w*, turns; and it is clasped against the opposite claw-like process at *u*.

Figs. 5, 6, 7, 8, and 9 are engraved after Prof. Mik's drawings.

Fig. 10.—Representation of the scarlet-red mite, *Trombidium fuliginosum*, which attaches itself to the hind leg of *Liburnia limbata.*

Fig. 11.—The head and mouth parts of the same, much magnified: the palpi should have been drawn with an extra articulation (*vide* description, p. 40).

Fig. 12.—The larva of an undetermined *Acarus*, infesting the bodies of *Liburnia.* It is of a yellowish colour, and with three rows of dark circular dots on the back.

G.B.B. del. et lith.

West, Newman imp.

PLATE XXXIX.

EUPELIX CUSPIDATA.* (Page 3.)

Fig. 1. — Male insect, with closed elytra. The reflexed rounded edge of the vertex, and the ocelli, are clearly shown.

Fig. 1 *a*. — Another example, with the wings expanded. Variation in the colouring of the scutellum may be noted.

Fig. 2, in Plate XXXVIII., vol. i. Shows the pupa with its strongly acuminate vertex, the central keels, also the half-developed alary organs.

Fig. 2 *a*, on the same plate.—Shows the under-side of the imago with the lanceolate frons, small clypeus, and rounded genæ or cheeks.

Fig. 2 *b*, same plate.—End of the female pygofer, drawn in profile after Fieber's figure.

STRONGYLOCEPHALUS AGRESTIS.† (Page 5.)

Fig. 2.—Male. Showing the ocelli on, or just within, the vertical ridge, and also the striated pronotum.

Fig. 2 *a*. — Female, which is larger, and generally seen without the costal spots on the elytra.

Fig. 2 *b*. — Under-side of the male pygofer, with its processes.

Fig. 2 *c*.—The same seen from above, more magnified. The short cauda and the long hairy lower projection recall the somewhat similar parts of *Cixius*.

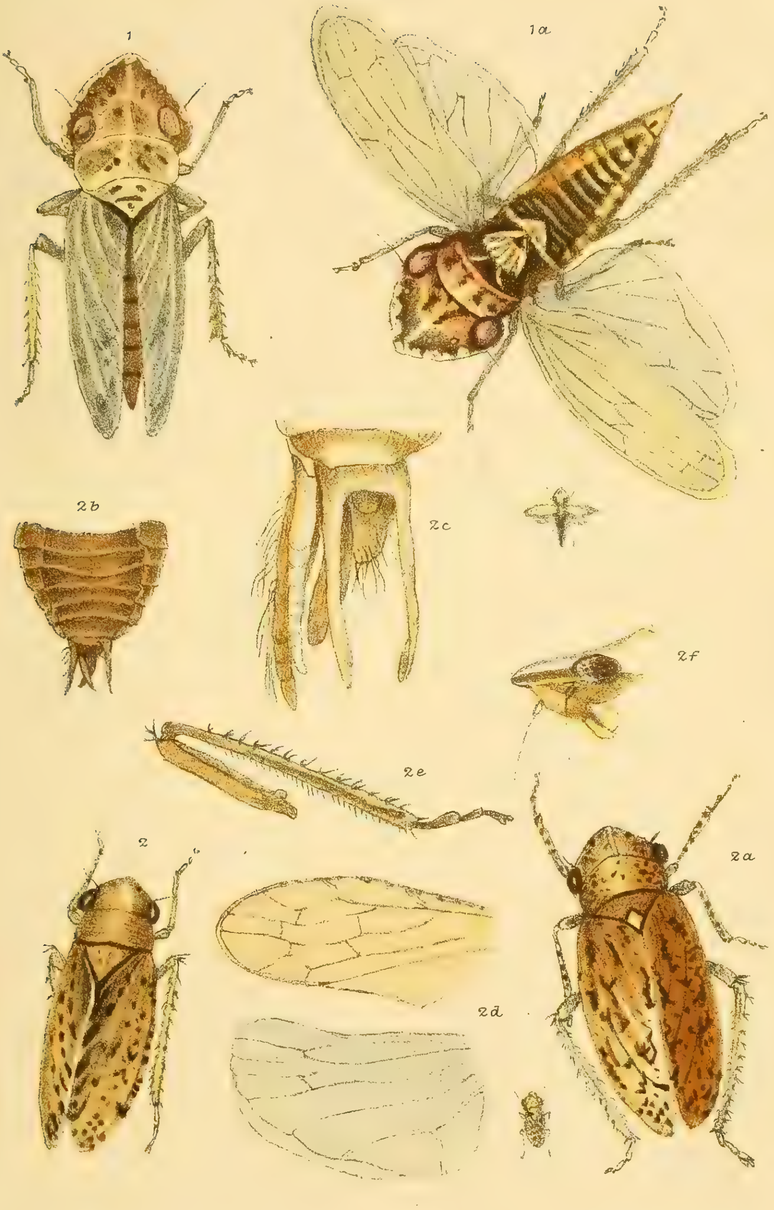
Fig. 2 *d*.—Elytron and wing of the male,

Fig. 2 *e*.—Hind leg, showing the setose and ciliated edges of the tibia.

Fig. 2 *f*.—Profile view of the head, showing, as in *Eupelix*, the eye half surrounded by the rim of the vertex; also the position of the antenna may be noted.

* From ευ and πελεκυς, an axe-head.

† From στρογγυλος, round-head.



G.B.B. del. et lith.

West, Newman chromo.

PLATE XL.

STRONGYLOCEPHALUS MEGERLEI. (Page 6.)

Fig. 3.—Imago of the female.

Fig. 3 *a*.—Front view of the head, with its sharper vertical ridge, and showing the deep pits from which the antennæ spring.

Fig. 3 *b*.—Pygofer of the same insect.

ACOCEPHALUS ALBIFRONS. (Page 7.)

Fig. 1.—Male, with its three black elytral fasciæ.

Fig. 1 *a*.—Head showing the pale frons, rounded genæ, oblong clypeus, &c.

Fig. 1 *b*.—Elytron and wing of the same. The nervures often are lost in the horny substance of the elytron.

Fig. 1 *c*.—Antenna showing its compound nature.

Fig. 1 *d*.—Hind leg. In error the stronger spines in this figure have been drawn on the inner edge.

N.B.—For other forms see the next plate.

ACOCEPHALUS BRUNNEO-BIFASCIATUS. (Page 12.)

Fig. 2.—Male insect with disjointed fascia.

Fig. 2 *a*.—Ventral aspect of the lowest part of the abdomen.

Fig. 2 *b*.—Genital valves and cauda of the same, more magnified. This figure is inverted with reference to the position of the preceding one.

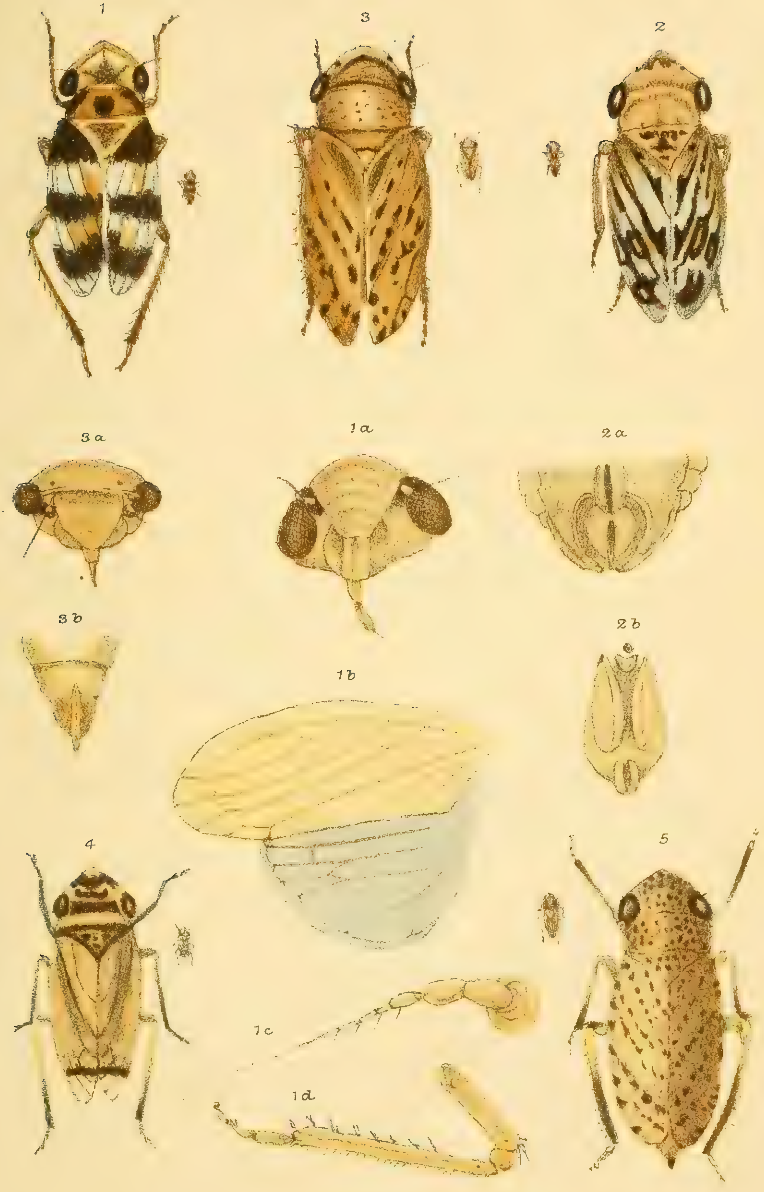
ACOCEPHALUS HISTRIONICUS. (Page 10.)

Fig. 4.—Male with the characteristic transverse elytral bar. For the female see next plate.

ACOCEPHALUS BIFASCIATUS. (Page 13.)

Fig. 5.—Female, which in this example is almost without the fascia to be noted in the male insect.

PLATE XL.



G.B.B. del. et lith.

West, Newman chromo.

PLATE XLI.

ACOCEPHALUS ALBIFRONS (*continued*). (Page 8.)

Fig. 1.—Female with the punctured head and pronotum.

Fig. 1 *a*.—Brachelytrous male of the same species.

Fig. 1 *b*.—Variety named *A. polystolus*.

Fig. 1 *c*.—Pygofer of the brachelytrous male, from the dorsal aspect.

ACOCEPHALUS HISTRIONICUS. (Page 10.)

Fig. 2.—Female insect.

Fig. 2 *a*.—Variety of male (?). (Page 9).

Fig. 2 *b*.—Abdominal apex seen from above.

ACOCEPHALUS FLAVOSTRIATUS. (Page 11.)

Fig. 3.—Male with tridentate mark on the vertex.

Fig. 3 *a*.—Female of the same, with more marked, less coloured, reticulations on the elytra.

ACOCEPHALUS NERVOSUS. (Page 14.)

Fig. 4.—Strongly marked variety, with irregular spots. The hind legs are commonly seen thus carried.

Fig. 4 *a*.—Pale variety of the same, and unspotted.

PLATE XLI.

G.B.B. del. et lith.

West, Newman chromo.

PLATE XLII.

PLATYMETOPIUS UNDATUS. (Page 16.)

Fig. 1.—The male imago with extended wings.

Fig. 1 *a*.—Another specimen, with closed elytra.

Fig. 1 *b*.—Frons, clypeus, and other parts of the face, viewed from below. The antennæ are placed very near to the frons.

Fig. 1 *c*.—The abdomen of the female, seen from the under-side, showing the rings, and particularly the emarginate ring, above the genital valves ; with part of the saw-like ovipositor between them.

Fig. 1 *d*. — Pygofer of the male, much magnified. The two genital plates are seen above, and, below these, the stout cauda is flanked on each side by a fine curved style. The shaded portion below these parts constitutes the processes, from between which probably the penis is exserted. This complex apparatus is enclosed within a horny sheath or box, furnished with tufts of double bristles.

Fig. 1 *e*.—The elytron with its small limbus.

Fig. 1 *f*.—The wing. Part of the membrane is seen finely corrugated.

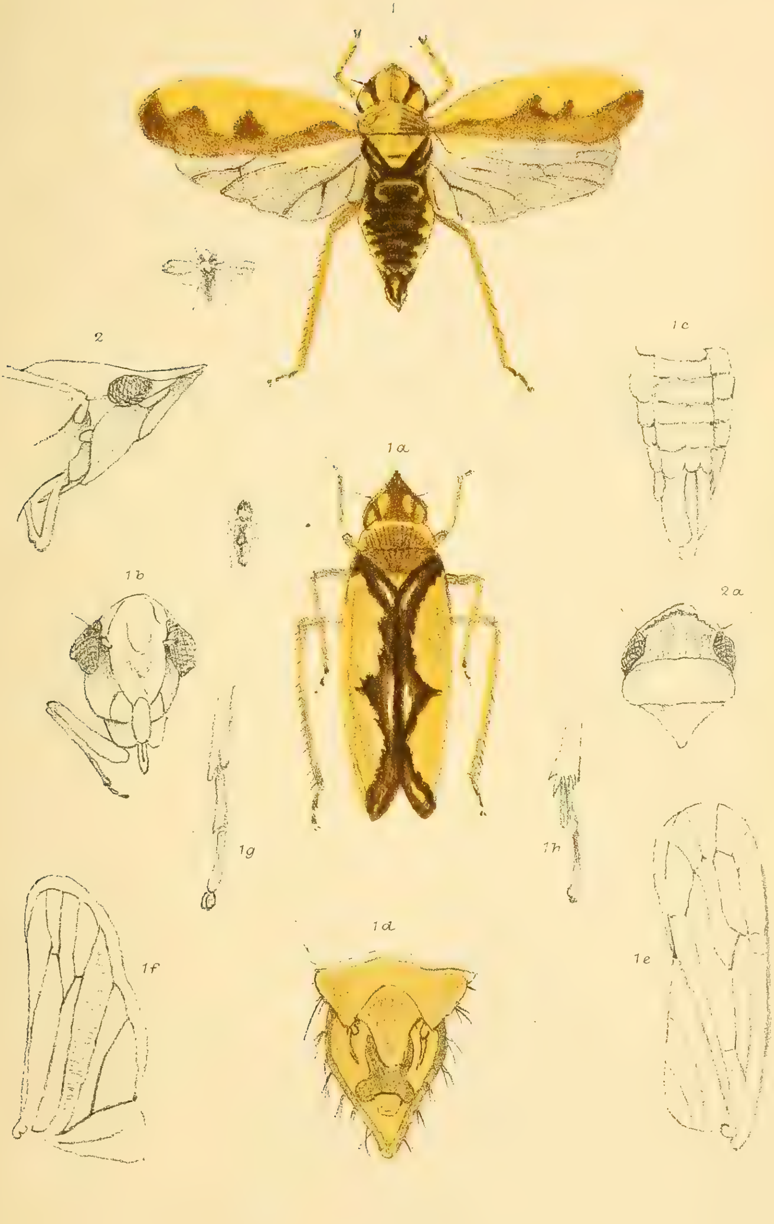
Fig. 1 *g*. — View of the hind tarsus.

Fig. 1 *h*.—Similar parts of the fore tarsus.

Fig. 2. — Profile view of the head of *Acocephalus nervosus*.

Fig. 3. — Upper side of the head of the same, showing the vertical carination.

PLATE XLII.



G.B.B. del. et lith.

West, Newman chromo.

PLATE XLIII.

Graphocræus ventralis. (Page 18.)

Fig. 1.—Imago, with its partly folded wings.

Fig. 1*a*.—Front view of the face, with its swollen frons and small genæ.

Fig. 1*b*.—Apex of the abdomen, with the point of the saw appearing within the notch formed in the last segmental plate.

Doratura stylata. (Page 19.)

Fig. 2.—Brachypterous form of the female, showing the rounded head, the punctured elytra, and the style-like termination of the abdomen.

Fig. 2*a*.—The front view of the face of the same, showing the trapezoidal frons and the rounded genæ.

Fig. 2*b*.—The brachelytrous male with its rounded pygofer and bronzed elytra.

Fig. 2*c*.—The pygofer of the female, with its emarginate lateral plates and its long saw-case.

Fig. 2*d*.—Under-side of the male, with the abdominal rings and the crossed genital valves.

Fig. *e* and Fig. *f*.—Front and hind tarsi.

Glyptocephalus proceps. (Page 23.)

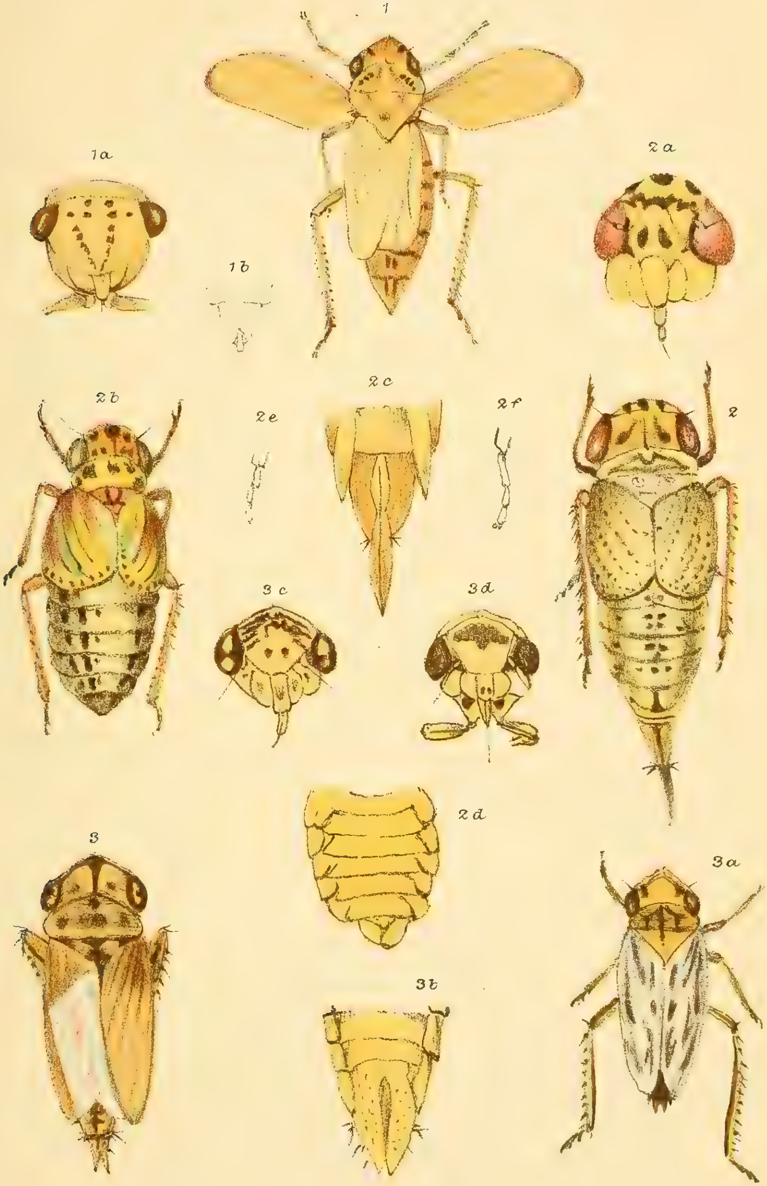
Fig. 3.—Female, showing the strongly sculptured, and striated characters of the head and the pronotum.

Fig. 3*a*.—Male of the same, with its blotched elytron and rounded pygofer. Var. *G. canescens*.

Fig. 3*b*.—Pygofer of the female, seen from the under-side.

Fig. 3*c*.—Frons and the rest of the face of the male of *G. canescens*.

Fig. 3*d*.—Frons and other parts of the female of *G. proceps*.



G.B.B. del. et lith.

West, Newman chromo.

PLATE XLIV.

PARAMESUS NERVOSUS. (Page 21.)

Fig. 1.—The pale variety of the male. Usually the male is much darker than the female.

Fig. 1 *a*.—The female, showing marked sutures on the pronotum.

Fig. 1 *b*.—The elytron and the wing of the same. The supplementary cellules and apical areas may be noted, as also the strong and thickened anal nervure of the wing.

Fig. 1 *c*.—Head and frons of the same insect.

Fig. 1 *d*.—Last abdominal rings of the female, seen partly in perspective.

PARAMESUS PHRAGMITIS. (Page 22.)

Fig. 3.—Male, with its linear form and ferruginous-red colouring on the head and pronotum.

Fig. 3 *a*.—Female of the same,

Fig. 3 *b*.—Face and frons of the same. The frons is finely stippled with dots.

Fig. 3 *c*.—Last abdominal ring of the male, from the dorsal aspect.

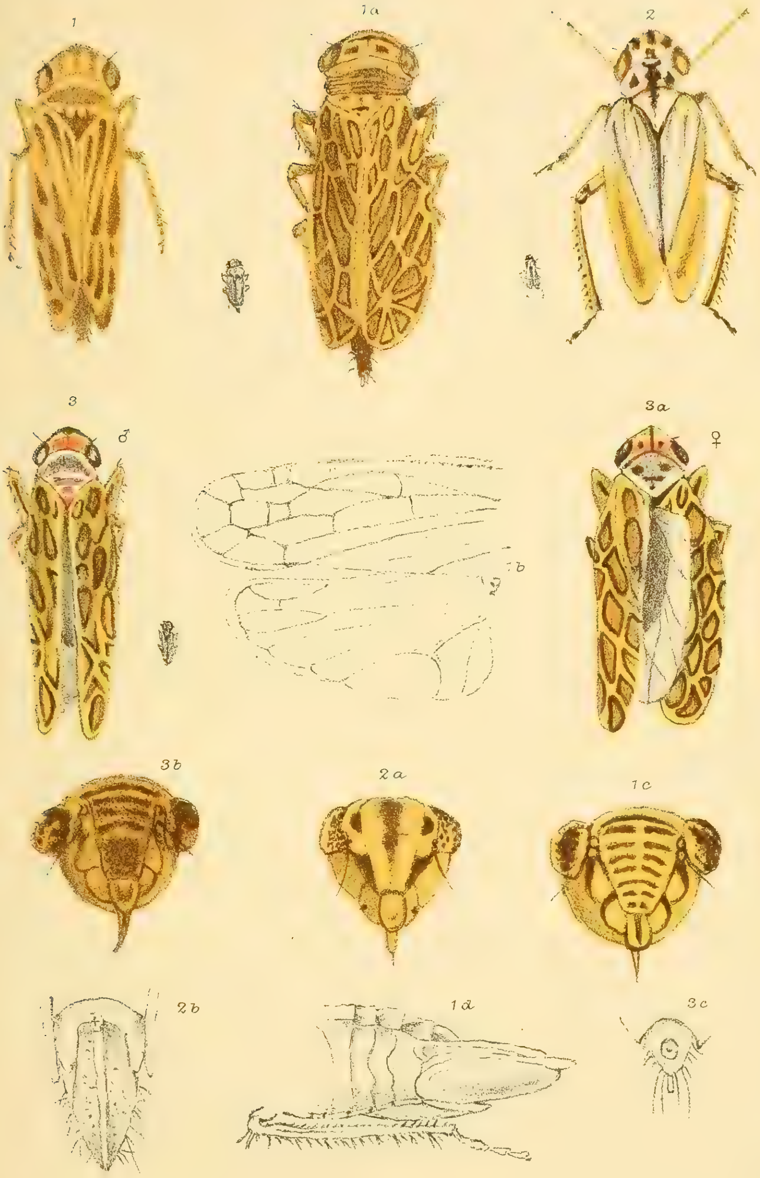
STICTOCORIS PREYSSLERI. (Page 24.)

Fig. 2.—Female insect.

Fig. 2 *a*.—Head and frons of the same.

Fig. 2 *b*.—Under-side of the female, showing the plate and genital valves.

PLATE XLIV



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West, Newman chromo.

PLATE XLV.

Athysanus grisescens. (Page 26.)

Fig. 1.—Winged imago, showing the coarse and dilated appearance of the nervures, and the reduced size of the wings.

Fig. 1 *a*.—The female, with closed elytra.

Fig. 1 *b*.—Pygofer of the male. seen in profile, with its singularly erect cauda, and its genital plates below.

Fig. 1 *c*.—Vertex, pronotum, and scutellum of the female, much enlarged. The pigment only partially fills the eyes.

Fig. 1 *d*.—The face, frons, &c., of the same.

Fig. 1 *e*.—The wing, with its neuration.

Athysanus russeolus. (Page 27.)

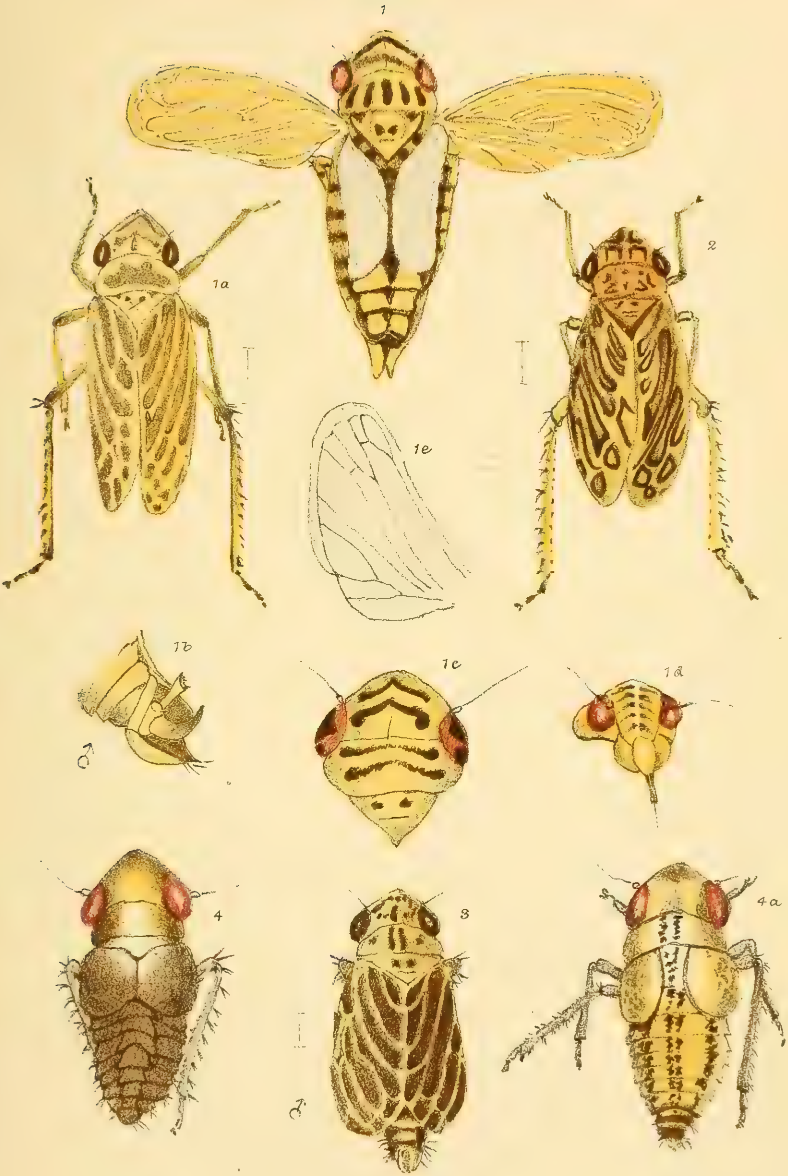
Fig. 2.—Imago, figured from a specimen in Mr. Douglas's cabinet.

Athysanus Sahlbergi. (Page 28.)

Fig. 3.—Male imago. Pygofer drawn on Plate XLVI.

Figs. 4 and 4 *a*.—Examples of the larval and pupal (?) forms of *Athysanus obsoletus*.

PLATE XLV.



G. B. B. del. et lith.

West, Newman chromo.

PLATE XLVI.

ATHYSANUS SORDIDUS. (Page 29.)

Fig. 1.—The female, with its pale elytra.

Fig. 1 *a*.—The more robust male, with its darker elytra and spotted pronotum.

ATHYSANUS MELANOPSIS. (Page 30.)

Fig. 2*a*.—Female, with its shining elytra and black frons.

ATHYSANUS BREVIPENNIS. (Page 31.)

Fig. 3.—Imago, with its rudimentary elytra and aborted wings.

Fig. 3 *a*.—Male, with the genital valves dilated.

Fig. 3 *b*.—Elytron showing the undeveloped condition of the neuration.

Fig. 3 *c*.—Part of the eye and the frons, showing the insertion of the antenna.

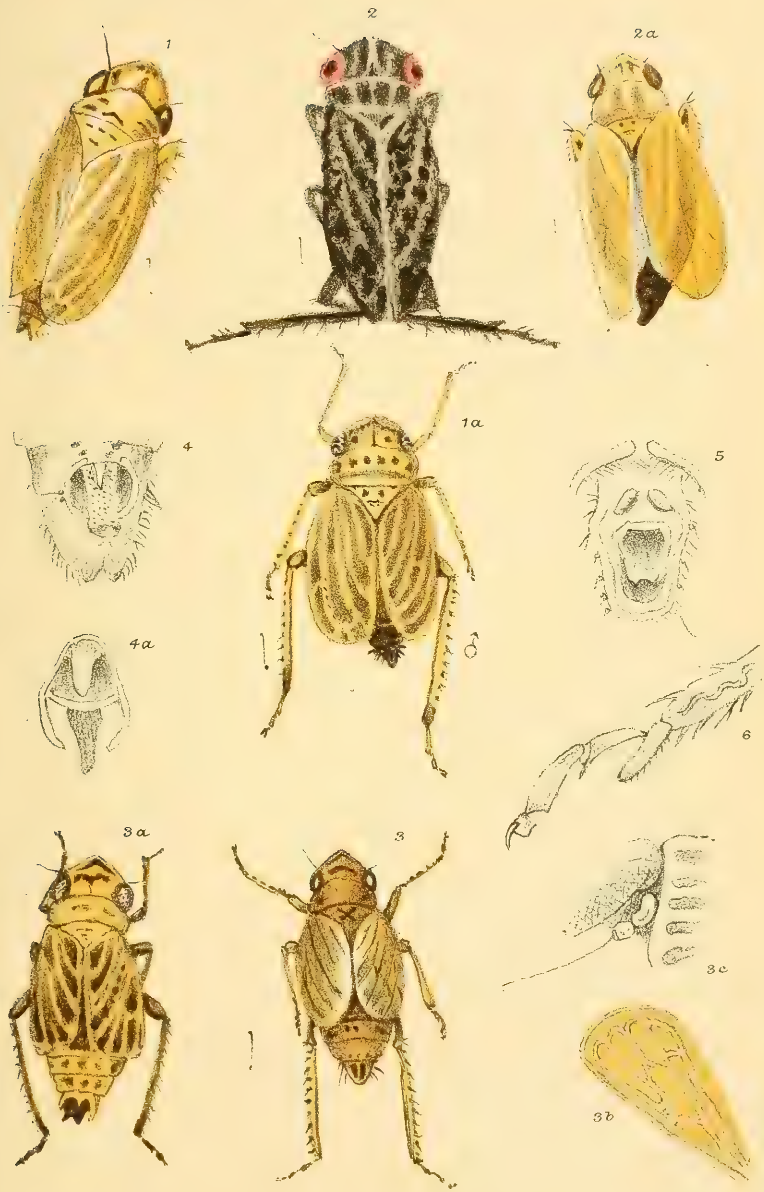
Fig. 4.—The male pygofer of *Athysanis communis*, with the aperture containing the cauda and style, and below these are seen the ciliated genital plates.

Fig. 4 *a*.—Pygofer of *A. communis* viewed from behind.

Fig. 5.—Male pygofer of *A. Sahlbergi*. Dorsal aspect.

Fig. 6.—Hind tarsus of *A. obsoletus*, showing the peculiar articulation of the three joints, with thəir delicate connecting membranes.

Fig. 2.—Male of *A. obsoletus*, called *A. piceus*.



G.B.B. del et lith.

West, Newman chromo.

PLATE XLVII.

Athysanus communis. (Page 32.)

Fig. 1. — One of the numerous varieties of the imago. Here the pronotum is ornamented with rows of oblong dots. The pronotum in some examples is still more numerously sprinkled. The abnormal transverse elytral veins may be noted.

Fig. 1 *a*.—A light variety of the same species, with the dots nearly obsolete.

Fig. 1 *b*.—Face, frons, and clypeus of the same.

Fig. 1 *c*.—Abdominal rings of the female, seen from above.

Fig. 1 *d*.—Elytron and wing showing the thickened marginal vein, instead of a limbus.

Athysanus obscurellus. (Page 32).

Fig. 2.—Imago almost completely covered by punctuations; the pronotum striated.

Fig. 2 *a*.—Head, frons, and the barred femur of the fore leg.

Fig. 2 *b*.—Fore foot, showing only two articulations.

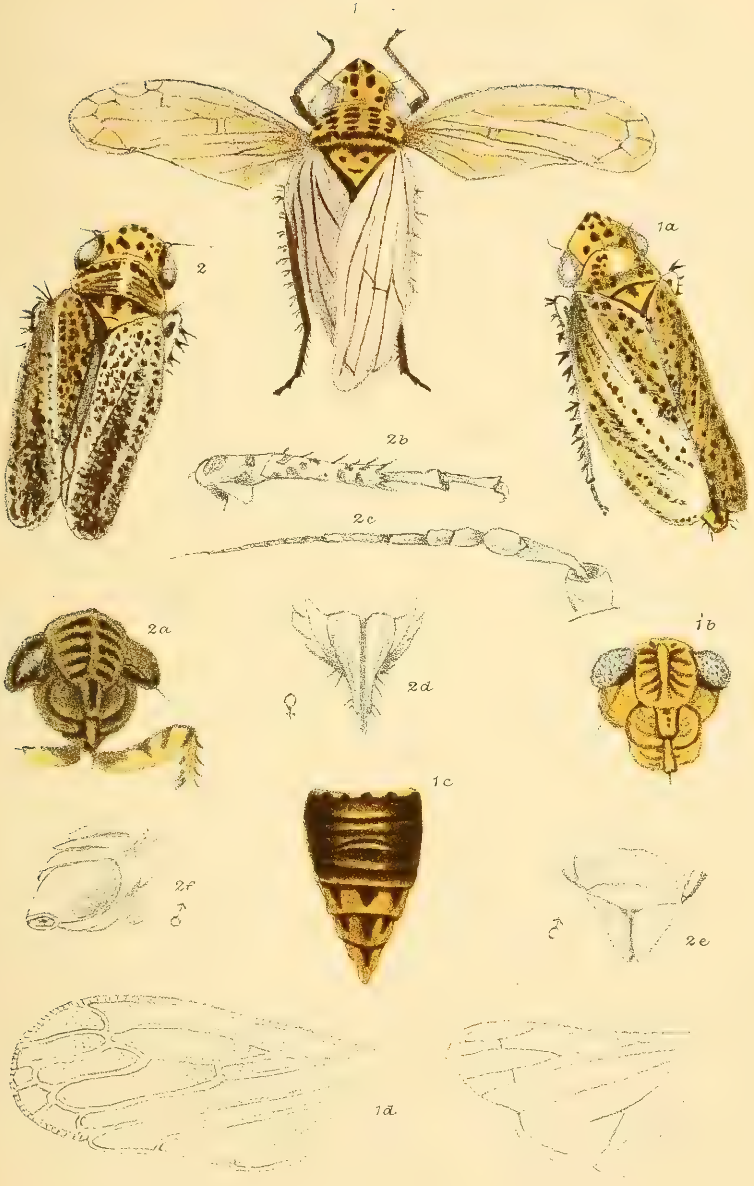
Fig. 2 *c*.—Antenna with multiform joints.

Fig. 2 *d*.—Under-side of the female pygofer.

Fig. 2 *e*.—Upper-side of the male pygofer.

Fig. 2 *f*.—End of the abdomen seen from beneath, and partly in perspective.

PLATE XLVII.



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West, Newman chromo.

PLATE XLVIII.

ATHYSANUS OBSOLETUS. (Page 33.)

Fig. 1.—Imago with the elytral nervures almost obliterated.

Fig. 1 *b*.—Pygofer of the male, with *s*, its styles, *c. c*, collaterial glands (?), and twisted penis, exserted under slight pressure. *r*. Horny ring.

Fig. 1 *c*.—Ovum showing the polar bodies at the obtuse end, the germinal spot, and the food-yolk globules.

Fig. 1 *d*.—The other acute posterior extremity.

Fig. 1 *e*.—The germinal spot under a high amplification. The commencing segmentation is obvious.

Fig. 1 *a*.—Inferior aspect of the female pygofer, showing, at *g*, the groove in which the serrated ovipositor lies when sheathed. *p*. The navicular plate. *m*. Upper genital plate. *n*. Part of the horny ring for the attachment of the muscles which work the saw. *r*. Horny ring to the saw groove.

DELTOCEPHALUS STRIATUS. (Page 50.)

Fig. 2. Imago. The neuration is lost in the substance of the elytron.

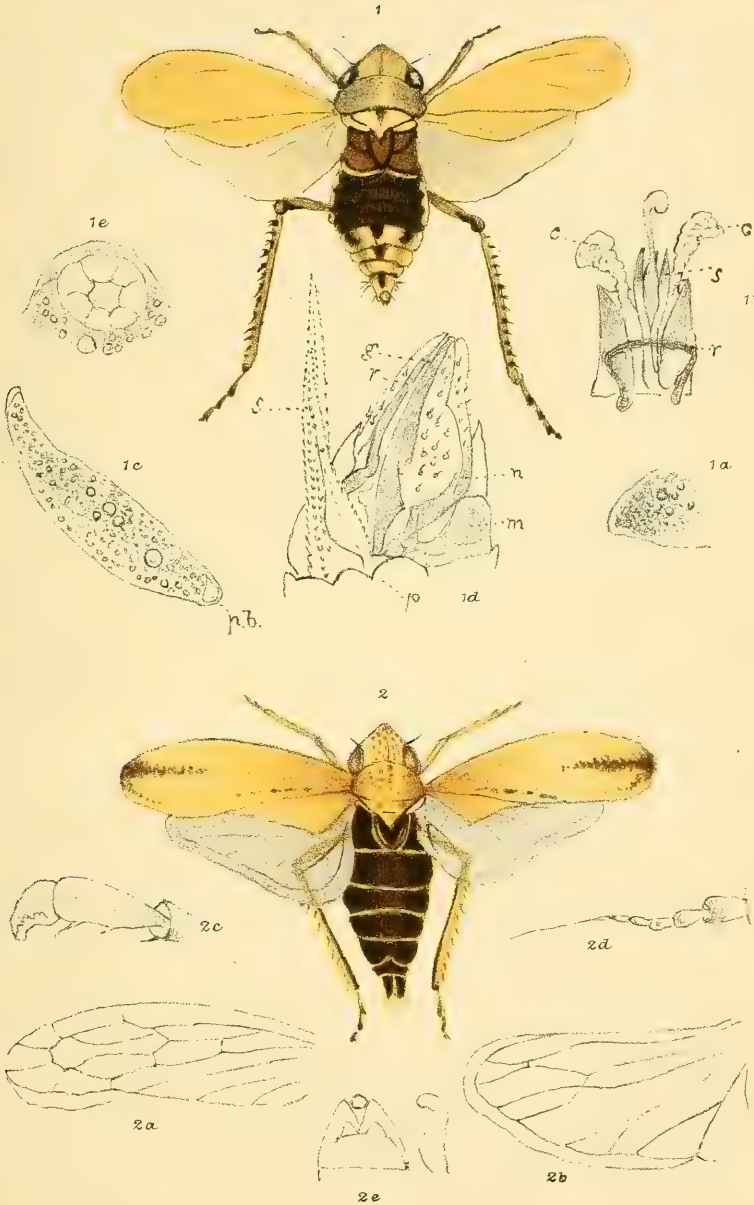
Fig. 2 *a*.—Elytron, with the nervures and limbus.

Fig. 2 *b*.—Wing of the same insect.

Fig. 2 *c*.—Tarsus of the fore foot.

Fig. 2 *d*.—Antenna.

Fig. 2 *e*.—Dorsal view of the male pygofer and one style. After Fieber.



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West Newma...

May, 1891.] [In Eight Parts.—Part VI.

MONOGRAPH

OF THE

BRITISH CICADÆ,

OR

TETTIGIDÆ,

ILLUSTRATED BY MORE THAN

Four Hundred Coloured Drawings.

BY

GEORGE BOWDLER BUCKTON, F.R.S., &c.,
COR. MEMB. ACAD. NAT. HIST. OF PHILADELPHIA,
MEMB. DE LA SOC. ENT. DE FRANCE.

"Sole sub ardenti resonent arbusta Cicadis."

"The small becomes the dreadful and immense."

VOLUME II.

London
MACMILLAN AND CO.
AND NEW YORK
1891

Price Eight Shillings

As heretofore, in difficult species of *Deltocephali*, the varying parts of the *pygofer* will be used as helps to discrimination; and, as far as possible, those external parts which can be brought into view, without much trouble or requirement of extra manual address, will engage attention.

Fieber recognises sixty-seven species of *Deltocephali* in his Catalogue of European Cicadinæ, and Dr. Puton increases this list to eighty-nine species; but John Scott remarks that "some of these probably will sink, though others may take their places." Mr. Edwards admits only twenty-three into his Synopsis, but there seem to me to be reasons in favour of curtailing his his list yet farther.

It has been before noticed that the winged veining of the Tettigidæ is often aberrant, but Mr. J. Edwards says that he has not, in a single instance, found that differences in the form of the genital styles are in any way correlated to the development of the elytra and wings. He places a very high significance on the forms of these styles.*

The Deltocephalidæ, like the Delphacidæ, show in several species a singular tendency to complete their reproductive systems before all the stages of their metamorphoses have been accomplished. Such conditions may be regarded if not of a larval, yet of a nymphal character. Side by side we find fully-winged forms with perfected genitalia; and other forms, with stunted or aborted wings, not much in advance of the alæ of pupæ still in their sheaths. These forms, nevertheless, are fertile.

The reproductive powers of some larvæ have deeply interested many biologists. It would appear that, through some excitation or abnormal activity, certain organs pass through their developmental changes at an increased rate, leaving other organs either in abeyance or simply progressing at their normal rate of increase, so far as time is concerned.

* Ent. Mo. Mag. xxv. p. 381.

Although the phenomenon of parthenogenesis is not involved in the reproduction of Cicadæ, I may quote, as relevant in a measure, Mr. McLachlan's remarks on the singular economy of the minute fly, *Miaster metroloas*. Mr. McLachlan says, "of all the marvels in the history of insects, the agamic production of larvæ from larvæ, until a brood arises which goes through its ordinary metamorphoses, and results in mature males and females, and thus re-commencing a cycle, is the most astonishing."

R. Wagner's discovery with reference to *Miaster* at first was met by the incredulity of even the best physiologists; but subsequent research has proved that this remarkable phase in insect economy is by no means so exceptional as was at first thought.*

The reproductive powers of the larvæ of some gnats are now recognised, and other examples might be adduced as proof of a remarkable economy. Charles Darwin, apposite to this subject, remarks that some animals show modes of transition through accelerated, or otherwise through retarded, periods of reproduction. If the reproductive powers of larvæ through larvæ became the general rule, the species, he thinks, would become changed and permanently degraded.†

At present there are no observations tending to the idea that the Cicadæ are at all agamic like the Aphides. Their dimorphic forms may be regarded by some as simple cases of degradation from higher, but less common, existing conditions of existence. Double broods of the Tettigidæ may be found in several genera, like *Eupteryx*, *Typhlocyba*, and others.

It is yet open to observers to make out if the genitalia of those forms which hybernate below ground ever in any way differ in form from the summer individuals of the same species. It may be noted that the reproductive larvæ of *Miaster metroloas* continue during the winter season until the spring, when in June the more normal reproduction commences.

* See Article 'Enc. Britannica,' p. 146. † 'Origin of Species,' p. 149.

Genus XXXVIII.—DELTOCEPHALUS, *Burm.*

Body elongated. Head and eyes together wider than the pronotum. Vertex deltoid—that is, more or less obtusely triangular. Ocelli rather distant from the eyes. Pronotum emarginate at the base. Elytra usually with five apical cells (ante-apical of Sahlberg), and they may be furnished either with or without a limbus. Wings often short, with the second longitudinal nervure normally forking, or else joining, with the first at a short distance from the apex. The second longitudinal nervure joining with the third, by a fork which is carried afterwards to the marginal vein, at a greater distance back. Outer edge of the anterior tibia finely ciliated. Legs moderate in length, with the posterior tibiæ fringed outwardly with fine setæ.

Some forms are dimorphous.

Dr. Sahlberg describes thirty-eight species.

Deltocephalus striatus, *Linn.* Plate XLVIII., figs. 2 to 2 *e*.

Cicada striata, Linn.; Schr.; Fab.; Fall.; Zett.
Jassus striatus, H.-Schff.; Thoms.
,, *strigatus*, Germ.
Deltocephalus striatus, Flor; Marsh.; Kirschb.; Fieb.; Sahlb.; Scott; Edw. pt. ii. p. 50.

Head pale ochreous, with obscure reddish mottlings. Vertical margins form nearly a right angle. Eyes pale brown. Pronotum with the basal margin straight and the fore margin nearly semicircular. Colour yellowish, with reddish blotches, and with three pale greyish stripes. Scutellum with a fine horizontal streak and three reddish dots. Frons brown, with a linear middle stripe. Abdomen fusiform, dark brown, with pale yellow segmental margins. Pygofer of male with a

yellowish tuft between the two brown lateral plates. Elytron yellow, longer than the abdomen, and furnished with five apical and three discoidal areas, which are feebly fuscous-brown. Elytron sometimes marked with an apical dark stripe. Nervures, if visible, whitish. Legs pale and ochreous. Hind tibiæ each with a fine dark inner stripe.

This insect is generally distributed, and rather common. Varieties occur in which the inner elytral areas are nearly filled with black. Mr. Edwards remarks that individuals taken in salt marshes are smaller, and that their elytra are scarcely as long as the abdomen.

	Inch.	Millimètres.
Expanse	0·26	5·60
Length	0·13	2·80

Deltocephalus abdominalis, *Fab.* Plate XLIX., fig. 1.

Cercopis abdominalis, Fab.
Cicada bicolor, Fieb.
,, *abdominalis*, Fall.; Zett.
,, *balteata*, Zett.
Jassus abdominalis, Germ.; Thoms.
Aphrodes juvenca, Hardy.
Deltocephalus abdominalis, Flor; Marsh.; Kirsch.; Fieb.; Sahlb.; Scott; Edw. pt. ii. p. 44.

Vertex pale, with a fine dark central line, sometimes accompanied by another short fine line on each side thereof. Eyes wholly or else partially brown. Ocelli not visible. Pronotum rather short, semicircular; yellow, with a greenish central spot, and sometimes with two faint basal stains. Scutellum furnished with two basal marks and a transverse one. Abdomen black. Male genital plates separately rounded at the apex, with their outer margins excised. Frons black,

with yellow transverse lines and a black middle stripe. Legs greenish or yellowish. Hind tibia with a dark inner stripe, the outer edge being furnished with brown setæ springing from black spots. Under side yellow, and spotted with black. Elytra greenish or greenish-grey; almost unspotted, with tips inclining to fuscous-brown. There are often pale white borders to the apical areas. Limbus absent, but the apical border is thickened.

Not uncommon. My figures are from specimens taken in Norfolk.

Size, 0·17 inch, or 4·50 millimètres.

DELTOCEPHALUS STRIIFRONS, *Kbm.* Plate XLIX., figs. 2, 2 *a.*

Deltocephalus striifrons, Kbm.; Sahlb.
,, *Mulsanti*, Fieb., Syn. Eur. Delto. fig. 44; Scott.
,, *longicaput*, Scott.
,, *striifrons*, Edw. pt. ii. p. 45.

Oblong, bright yellow above. Head and eyes together rather broader than the pronotum. Vertex with two short, brown, angular marks at the apex, and with a fine medial line. Eyes greyish, but variable in colour. Pronotum and scutellum concolorous. Frons lozenge-shaped and pointed; bright yellow, with irregular brown stains at the sides, forming, by contrast with the centre, a kind of coarse striation. Brown stains occur on the genæ and clypeus. Abdomen yellow above; last segment brown, with yellow tufts of hair. Legs yellow, banded, and striped with brown. Genital plates yellow, separately rounded at the apex, their inner margins two and a half times as long as the valve.

Taken on the rest-harrow, *Ononis*, and on clover, *Trifolium*, "on the South coast." Not common.

Size, 0·14 inch, or 3·75 millimètres.

From the want of material I am unable to confirm Sahlberg's diagnosis, but the cubital vein of the species is described by him as "conjuncta cum trachio venis duabus transversalibus."

Deltocephalus pascuellus, *Fall.* Plate XLIX., figs. 3, 3 *a*, and Plate L., fig. 5.

Cicada pascuella, Fallen.
Jassus pascuellus, Thoms.
Deltocephalus pascuellus, Flor; Marsh.; Kirschb.; Fieb., Syn. Eur. Delto. fig. 46; Sahlb.; Scott; Edw. pt. ii. p. 46.
Deltocephalus luteolus, Kirschb.
,, *fuscosignatus*, Dahl.
,, *Minki*, Fieb., *l. c.* fig. 45; Scott.

Somewhat linear in form. General colour greenish, with whitish edges to the elytral areas. Vertex yellow, rather more obtuse than that of *D. striifrons*. Vertex of the male with a faint medial line between two minute dots. Pronotum green, and a trifle longer than the vertex. Scutellum with two brown stripes and a fine transverse line. Elytra longer than the abdomen; the nervures appearing whitish, from the areas being only partially charged with green, or fuscous-yellow. Abdomen black in the males. Fore legs spotted; the middle and hind legs each with a dark dash in the femur, and with a more decided line on the inner edge of the tibia; outer edge with black spots and tufted setæ.

Female much larger than the male, with the vertex, pronotum, and scutellum almost immaculate. An inverted V-like mark occurs on the apex of the crown. Abdomen longer than the elytra, with its last ring tufted and yellow. Frons brown, with pale transverse lines.

The pygofer of the female (see Plate L., fig. 5) has

a somewhat complex structure. The ensiform lateral processes are partly projected beyond the deeply notched plate; and between these the saw and the saw-case are partly protruded. The caudal rectal process, also, is seen above these parts, and would appear to be tubular in structure.

On Mr. Edwards' authority I include Fieber's *D. Minki* amongst the synonyms. Mr. Edwards believes, from a specimen he has seen, and which was named *Minki* by Dr. Puton, that it would agree with *pascuellus* by the allowance only of a slight modification of form in the lower margin of the male pygofer.

Common in England on damp grasses, from July to September; and common also at the same season in Finland, Scandinavia, and in France.

Size, 0·14 inch, or 3·50 millimètres.

DELTOCEPHALUS LINNEI, *Fieb.* Plate XLIX., fig. 4.

Deltocephalus Linnei, Edw. pt. ii. p. 51.
,, *I-album*, Scott (?).

Vertex with the sides slightly arcuate. General colour of the insect pale ochreous. Disc of the crown slightly stained with ferruginous-brown, with one central and two diagonal lines. Pronotum shorter than the vertex, with four oblong brownish marks, leaving as many yellowish perpendicular bars between them. Scutellum with the afore-mentioned mask-like marking. Elytra pale brownish yellow, longer than the abdomen, and with brownish nervures. "Nerves milk-white, with the first transverse nerve much thickened."—Edwards. Legs yellow, spotted, and striped. Abdomen black. Hind margin of the last ventral segment sinuous in the female, taking somewhat the form of an ogee arch.

This insect seems to be rare. My figure is from a specimen taken in July on the sea-shore near Romney, Kent. It occurs also on the sea-shore at Hastings.

Size, 0·15 inch, or 4·10 millimètres.

Scott gives as characters for his *D. I-album*, "Face bone-white; frons black, with three transverse pale lines, the white I-shaped character across the transverse nerve of the basal area of the corium: these alone afford characters for easy recognition." Nevertheless, he "is not prepared to see the name positively retained." As this description only fairly agrees with my specimens, I have queried the synonym.

DELTOCEPHALUS CITRINELLUS, *Kbm.* Plate XLIX., figs. 5 to 5 *g*.

Deltocephalus citrinellus, Kirschb.; Sahlb.
Jassus cephalotes, H.-Schäff.
Deltocephalus assimilis, Fieb., Syn. Eur. Delto. fig. 41; Scott.
D. cephalotes, Ferrari, Cicad. Agri. Ligust.
D. brachynotus, Fieb.
D. citrinellus, Edw. pt. ii. p. 47.

Female long-oval. Vertex angularly obtuse. General colour greenish. Eyes brown. Pronotum narrow, greenish, with faint blotches. Scutellum concolorous with the head. Elytra yellow or yellowish green, longer than the abdomen; apical borders clouded with brown, without a limbus; costal and claval sutures very stout. Apical cells four, and discoidal three, in number. Wings small. Legs yellow, striped and spotted with black. Abdomen dark brown, with sides widely yellow. Last ventral segment yellow; hind margin nearly straight. Frons pale brown, but darker than the rest of the face. Navicular valve of the male nearly equilateral. Terminal valves nearly twice the length of the navicular.

Moderately common in July on sunny banks near Haslemere and other places.

Size, 0·14 inch, or 3·50 millimètres.

DELTOCEPHALUS ARGUS, *Marsh.* Plate L., figs. 1 to 1 *b.*

Fieb., Syn. Eur. Delto. fig. 17; Scott; Edw. pt. ii. p. 56.

Upper side pale yellowish brown, with a darker smoky-tinted vertex, pronotum, and scutellum, all of which are nearly spotless. Elytron longer than the abdomen, and ornamented with five or six annular or plain brown spots, and a brown streak at the apex of the clavus; the apex brown. Abdomen black. Legs pale, smoky, banded, and spotted with black. Male genital plates very small. Caudal process longer than the genital plate, and the structure apparently tubular. The head and pronotum of some specimens are very pale, instead of being smoky-brown and obscurely spotted with black.

Rare, but widely distributed. Occasionally found in September in the open fields round Haslemere.

Size, 0·14 inch, or 3·50 millimètres.

DELTOCEPHALUS FALLENI, *Fieb.* Plate L., figs. 2, 2 *a.*

Fieb., Syn. Eur. Delto. fig. 24; Sahlb.; Scott; Edw. pt. ii. p. 52.

Very like *D. distinguendus;* but the insect differs in certain characters of the genitalia. "Genital plates in the male reflexed, three times as long as the valve, sinuate on their outer margins, and obtusely rounded at the apices. Side lobes of the pygofer scarcely shorter than the anal tube, but somewhat longer than the plates." "A middle incurved tooth at the apex, and a strong tooth in the middle of the lower margin."

The above diagnosis is in part from Mr. Edwards' Synopsis.

This insect has rarely been taken in Britain; but

through the courtesy of Dr. P. Mason I am enabled to draw specimens from his cabinet which originally were in Mr. Scott's collection, and were named by Sahlberg. These insects are more robust in form than *D. distinguendus*, and the elytra of the female are less mottled in colour, and considerably shorter as measured by the abdomen. The vertex also shows two spots which probably indicate the position of ocelli. Dr. Mason possesses only three foreign somewhat dissimilar specimens, which I here shortly describe :—

No. 1.—Honey-yellow, squat in form, shining, and almost spotless. Elytral nervures whitish. Abdomen rather darker than the rest of the body, with its apex recurved. The pygofer has an oval-shaped chamber at the extremity.

No. 2.—Body rather darker, with the abdominal apex deeply cleft, and showing a projecting style on each side of the cauda. The dorsal part of the abdomen darkest. The pronotum shows seven or more dots on its disc.

No. 3.—Very similar in colour, with dark tibia and tarsi. The caudal process large within the oval chamber. I have not been able further to examine the genitalia of these specimens.

There seems to be considerable doubt as to the propriety of admitting *D. Falleni* to be a true species.

Size, 0·14 inch, or 3·50 millimètres.

Deltocephalus sabulicola, *Curt.* Plate L., figs. 3, 3 *a*.

Apterodes sabulicola, Curt., Brit. Ent. pl. 633.
Deltocephalus avenicola, Sahlb.
,, *sabulicola*, Marsh.; Fieb., S. E. D. fig. 29; Scott; Edw. pt. ii. p. 53.

Crown shorter than its width. Colour pale rusty ochreous, with or without faint brown or reddish

mottlings. Pronotum about equal to the crown in height, with two or more punctures, and sometimes with pale or whitish stripes. Scutellum small. Abdomen large and fusiform; colour bright orange-yellow, with broad brown bands on the segmental rings, leaving the orange colour in fine cross stripes. Pygofer orange, and cleft at the apex. Legs yellow, with a few or else no black points. Setæ yellow. Elytron warm ochreous-yellow, with six irregular black spots, three of which are generally seen on the clavus: these spots are sometimes annular, and not constant in their positions. Wings iridescent. The genitalia are very similar to those of *D. striatus*.

Very common on the sea-shore at Romney Marsh and other like places.

	Inch.	Millimètres.
Expanse	0·24	6·10
Size	0·15	3·81

Deltocephalus punctum, *Flor*. Plate L., figs. 4, 4 *a*, and LV., fig. 4.

Deltocephalus punctum, Flor; Marsh.; Kirschb.; Sahlb.; Scott; Edw. pt. ii. p. 55.
D. costalis, Fieb.?

Vertex and pronotum warm ochreous-brown; the former long in proportion to its width. A fine brown line occurs on each side, running from the apex to the eye and very near to the margin. Eyes dark brown. Pronotum shorter than the vertex; with or without four linear white stripes. Scutellum with three black points. Legs ochreous. Hind tibia with a fine dark inner line and tufted yellow setæ. Tarsi tipped with brown. Elytron pale ochreous, somewhat hyaline. Apical areas feebly margined with brown. A conspicuous black spot on or at the point of the fourth apical area, with sometimes a smaller one near the costa.

Found amongst dry bents and fine grasses in many places. The form occurs both in the macropterous and in the brachelytrous condition.

Size, 0·12 inch, or 2·50 millimètres.

DELTOCEPHALUS DISTINGUENDUS, *Flor*. Plate LI., figs. 1 to 1 *b*, and LII., figs. 3, 3 *a*.

Deltocephalus distinguendus, Flor; Fieb., S. E. D. fig. 21; Scott; Edw. pt. ii. p. 51.
,, *pseudocellaris*, Flor; Thoms.; Sahlb.
,, *propinquus*, Edw. (not of Fieber).

Male. General colour ochreous-yellow. Vertex pointed and shaped like an equilateral triangle. Pronotum much shorter than the vertex, and, like it, obscurely clouded with brown stains, or marked by three white stripes. Scutellum small and yellow. Eyes pale brown, and often spotted. Abdomen semi-globose and black; its apex ending with two conspicuous plates. Legs rather short and stout, yellow; the hind tibia being furnished with a brown inner stripe and numerous coarse setæ. Elytra longer than the abdomen, fuscous-yellow, with the areas towards the apices obtuse, and more or less bordered within by faint brown or fuscous tints. The spaces between these areas, down which the nervures run, whitish. Wings grey. Genital plates large, black, and reflexed.

The pygofer is complex, and may be thus shortly described. Details appear in Plate LII., fig. 3. The œdeagus is formed of an oblong deep chamber surrounded by a strong marginal wall or ring, above which a short black style protrudes from a space walled in by the prolongation of the strong lateral processes. These processes cross over part of the floor of the chamber. Between them and below the above-mentioned small style, the blunt rectal cauda is situated.

The significance of these curious details of the

pygofer is at present obscure, and little would be gained by assigning functions to such parts, upon the few observed facts now at our disposal.

Both Dr. Fieber and Mr. Edwards give some description of the external genital apparatus of *D. distinguendus.* They chiefly relate to the angular forms and the relative lengths of the plates and other parts appertaining thereto.

A review of the numerous figures I have already given, of the genitalia of the species hitherto described, will lead to the conclusion that the details have much in common with the male parts of the Heteropterous Hemiptera described in Dr. David Sharp's recent suggestive and interesting paper on the Terminal Segment in some male Hemiptera (Trans. Ent. Soc. London, part iii. 1890, p. 399).

It will be well to defer remarks upon the probable homologies of certain parts as developed in the two families until the varied forms of the pygofers of the Typhlocybidæ come under description.

Female. Almost immaculate yellow, with a vertex browner than that of the male. The elytra often are in this sex considerably shorter than the abdomen.

D. distinguendus does not appear in Sahlberg's treatise of Cicadariæ; but in his diagnosis of *D. pseudocellaris* he says, "Vertice acutius producto, latitudine sua basali et pronoto ¼ longiore, medioquam lateribus fere duplo longiore," &c. Also, he continues, "Genis extus obtuse dilatis — pronoto obsoletissime albido vittato, "&c. (Sahlb., 'Kapets, pro fauna et flora Fennica,' p. 314).

Mr. Edwards includes *D. pseudocellaris* amongst his synonyms of *D. distinguendus,* and I am inclined to follow his lead; although, amongst my examples of the latter insect, certain discrepancies occur, which do not, however, appear to me of great moment. Both the above authorities lay stress on what proportion the height of the vertex or crown bears to the length of its base; and also on the outlines and curves of

the "notches on the sides of the hind margin of the last ventral segment."

The variability of this and other species seems to preclude such minute characters from a sharp and certain diagnosis; and discrepancies here, between specimen and specimen, must be almost anticipated. Mr. Edwards, indeed, alludes to such variations.

D. distinguendus is one of our commonest *Deltocephali*. The larvæ of the Deltocephalidæ are what may be called almost grotesque in their forms, with their heads and eyes exceeding the width of their bodies; their abdominal parts, which taper to an apex; and their hairy legs, which are stout and somewhat shorter than those seen in the imagos.

DELTOCEPHALUS CORONICEPS, *Kirschb.* Plate LI., fig. 2.

Deltocephalus coroniceps, Kirschb.; Edw. pt. ii. p. 57.
Thamnotettix coroniceps, Fieb., Cicad. d'Eur. p. 70.

My knowledge of this insect is limited to a single example in the possession of Dr. Piffard, who kindly enables me thus to describe it:—

Form somewhat linear. Colour bright yellow, with ill-defined whitish marks on the pronotum. (Edwards says, also, such are seen on the crown.) Vertex shorter than its basal width; with a row of black dots on the apex, the middle dots of which are the largest. Five or six minute dots are ranged transversely on the pronotum. Scutellum yellow and spotless. Elytra rather shorter than the abdomen, which is pale brown, with a yellowish apex, and well tufted with setæ. The elytra are obscurely stained with fuscous-yellow, and the courses of the nervures appear whitish and shining. Legs rather long, bright yellow, and all spotted with pale brown dots. The hind tibiæ are without any inner stripe.

"The genital valve of the male very widely rounded, about half as long as the preceding segment."

Edwards gives, as a habitat, "One example, taken August, 1887; Coxford Heath, Norfolk." He notes that it has nothing in common with *D. coronifer* of Marshall, except as to the pattern on the forehead.

Size, 0·14 inch, or 3·55 millimètres.

Deltocephalus Normani, *Scott*. Plate LI., fig. 3. Edw. pt. ii. p. 55.

Considerable doubts may be expressed as to the propriety of admitting this insect to be distinct from *D. striatus*, or perhaps from *D. repletus*. Practically no important points of difference appear in the diagnosis of Mr. Edwards' Synopsis; who notes also its similarity to *D. striatus*, and records the meagre capture (by Mr. Geo. Norman) "of one male and two females on high heathery land in Morayshire."

Dr. Piffard kindly lent me a specimen labelled *D. Normani*, but it hardly agrees with the diagnosis given by Scott. Indeed, in its appearance it less recalls to me the form of *D. striatus* than that of *D. repletus*. I have introduced a figure of Dr. Piffard's insect into my plate for comparison with *D. coroniceps*. In its spotted fore legs it resembles the species I have just before described, with which, however, it cannot be well confounded. The elytral areas are inwardly bordered with fine dark lines, without being suffused with fuscous-brown.

Size of Dr. Piffard's insect, 0·11 inch, or 2·79 millimètres.

Deltocephalus socialis, *Flor.* Plate LI., figs. 4 to 4*d*.

Deltocephalus socialis, Flor; Marsh.; Kirschb.; Fieb., S. E. D. fig. 8; Sahlb.; Scott; Edw. pt. ii. p. 53.
D. quadrivittatus, Marsh.
Jassus socialis, Thoms.

Male. General colour ochreous. Shape of the head, with the eyes, equilateral. Vertex pointed, with a dark line bordering the apex. Inter-ocellar line indicated by a point at each ocellus; these points, however, are not always to be seen. Pronotum semicircular in form, with four oblong stains, marking out five pale vertical lines. Scutellum nearly spotless. Abdomen robust, orange-yellow, with broad brown bands. The penultimate segment shows two black spots. Apex fringed and cleft, with two black lateral valves. Lower margin of the genital plate rounded. Elytra shorter than the abdomen, dirty ochreous-brown, with clouded areas, and the nervures, indicated by broad pale borderings. Legs ochreous-yellow. Middle and hind tibiæ with one inner stripe. Hind tibiæ with black points and ochreous setæ. Under side almost wholly black, except the coxæ and the legs. Frons pale brown, with darker transverse bars.

Female. Larger and paler in colour than the male; uniformly ochreous, with much shorter elytra. The pygofer, seen from above, is cleft, and provided with a blunt interior tooth. Viewed more from behind, it shows a stout cylindrical cauda. The pygofer of the male does not exhibit the singular form of the œdeagus and apparatus noted in the male of *D. distinguendus*.

Externally, to the naked eye, this insect in many respects resembles *D. distinguendus*, and this similarity may also be seen even when we compare the diagnosis of the two species as given in Edwards' Synopsis. The differences, as there given, may be stated in great

part thus:—*D. socialis* has a black patch on the pygofer. The genital valve is less than half the length of the genital plate. The side lobes are inflexed, and the hind margin of the ventral segment in the female rather strongly concave; with a middle notch. In *D. distinguendus* there is no black patch; the genital valve is one-third the length of the plate; the side lobes of the pygofer much shorter than the plates; the middle lobe of the pygofer is wide, with an angular notch on each side.

This insect occurs both in the macropterous and brachypterous forms. It is locally distributed, but in some seasons by no means uncommon.

Size, 0·12 inch, or 3·00 millimètres.

DELTOCEPHALUS PULICARIS, *Fall.* Plate LII., figs. 1 to 1*c*.

Deltocephalus pulicaris, H.-Schäff.; Thoms.; Flor; Marsh.; Kirschb.; Sahlb.; Scott; Ferrari; Fieb., S. E. D. fig. 27; Edw. pt. ii. p. 58.

This common species is very variable in its markings; the head and pronotum of some specimens, like those shown in my figures, being almost spotless; whilst others, which probably are the most common forms, are spotted conspicuously with black.

Very small. General colour brownish yellow, or almost black. Vertex shorter than wide, and, taken together with the eyes, broader than the pronotum. Scutellum small. Two large round black spots between the eyes are often seen in well-marked specimens, with smaller spots on the apical border. A fine vertical line divides the crown. Abdomen shining black; apex blunt and coarsely tufted. Genital plates three times longer than the genital valve. Elytra non-limbated and shorter than the abdomen; in some specimens *much*

shorter; with five, and sometimes six, apical areas. Occasionally specimens may be seen with the membrane almost entirely transparent, whilst in others the fuscous-brown areas are marked out with wide yellowish borders. Finally, specimens may be found of a sooty-grey colour, with fine linear marks indicating the elytral areas. Wings very short. Legs rufous-yellow and spotted with black. Tarsi thick. Frons dark brown or sooty-grey, with obscurely barred ochreous-brown striations. Examples may be found with the abdominal rings edged with yellow.

Perhaps this is our smallest *Deltocephalus*. It occurs everywhere, and is very common over all mid-Europe. It is a hardy species, and lives throughout our winters. In March, 1891, after the great snow-storm, I found it quite numerous and active at the tops of the cliffs at Ventnor, whilst the snow was still deep in the drifts. I have specimens also from Malvern, Bristol, Norfolk, Southsea, and elsewhere.

	Inch.	Millimètres.
Size	0·078	2·2
Expanse	0·19	5·0

DELTOCEPHALUS FLORI, *Fieb.* Plate LII., figs. 2 to 2*b*.

Deltocephalus Flori, Fieb., S. E. D. fig. 25; Scott; Ferrari; Edw. pt. ii. p. 50.

Vertex longer than pronotum. Colour pale and whitish, with a fine medial line; on each side of which three roundish orange-yellow spots are ranged. Four similar spots occur on the disc of the pronotum, together with an additional lateral spot. Elytra rather short, rounded at their apices, with coarse and greyish raised nervures, enclosing olive-green areas. Frons all grey-black, with blacker spots superposed. Legs yellow, spotted with black. Tarsi dark brown. Abdomen also dark brown, with broad yellow bands, and a tufted apex of the same colour.

Fieber gives pygofer of the female with "fast 4 eckig trapezförmiger schwartz gesäumter Mittelplatte."

Size, 0·12 inch, or 3·00 millimètres.

Not common, but occasionally taken on the grasses on the hills above Haslemere. Pitlochry, Perthshire.

DELTOCEPHALUS OCELLARIS, *Fall.* Plate LIII., figs. 1 to 1*g*.

Cicada ocellaris, Fall.; Zett.
Jassus ocellatus, H.-Schäff.
Deltocephalus ocellaris, Flor; Marsh.; Kirschb.; Thoms.; Fieb., S. E. D. fig. 9; Sahlb.; Scott; Edw. pt. ii. p. 47.

Shining, yellowish white. Vertex with two orange spots near to the apex, followed by two larger spots nearer the base. Eyes sometimes grey-spotted, and sometimes brown. Pronotum about equal in length to the vertex, of the same colour, and ornamented with oblong yellow spots, which cause this part to appear to be barred with white. Scutellum small and spotted. Abdomen brown and robust. The three apical rings yellow, and broken often into bars of brown. Frons blackish brown, more or less spotted with yellow or striated with ferruginous. Legs yellow, and spotted with ferruginous-brown. Elytron rounded at the apex, with five apical and three discoidal cells. The marginal area is cut up into four or more small supernumerary cells. Areas fuscous-brown, with whitish edgings which are more or less in relief.

	Inch.	Millimètres.
Expanse	0·24	6·09
Body	0·14	3·55

Very abundant at Haslemere and other places.

DELTOCEPHALUS OCULATUS, *Sahlb.* Plate LIII., fig. 2. Scott; Edw. pt. ii. p. 49.

Colour orange-yellow. Vertex shorter than the pronotum, with a fine line bordering the apex. Pronotum with four obscure orange spots and a grey basal stain. Scutellum with two brown basal marks, and a small annular one. Legs orange-coloured. Lower parts of the hind tibiæ dark brown. The tarsi blackish. Elytron longer than the abdomen, brownish white, with browner areas. The nervures shining white.

This description is from an example originally in Mr. Scott's collection, and probably named by Sahlberg. It was sent to me by Dr. P. Mason.

In addition to the above diagnosis, Mr. Edwards gives "strongly thickened nervures, and two white spots on the suture of the elytra. Evidently closely allied to *D. repletus*, Fieb."

Size, 0·14 inch, or 3·50 millimètres.

DELTOCEPHALUS REPLETUS, *Fieb.* Plate LIII., figs. 3 to 3 *b*.

Deltocephalus repletus, Fieb., S. E. D. fig. 20; Scott; Ferrari; Edw. pt. ii. p. 49.

Somewhat linear in form. Vertex longer than the pronotum. Slightly arcuate at the sides, ferruginous-red, with a white cross dividing it into four larger and four smaller spots. Eyes large and grey. Pronotum short, with four or five white bars. Scutellum with brown basal marks. Elytron at least equal in length to the abdomen, ochreous-yellow, with many irregularly shaped eye-like marks of brown, indicating the position of the areas. Apical areas small, and darker in their

edgings. Legs pale, sparsely spotted with brown. Some specimens show the pronotum furnished with seven or more ferruginous vertical dashes.

My figures are from insects in Mr. Edwards' collection. He notes it "scarce," but that he has taken the insect singly in three localities in Norfolk.

Size, 0·13 inch, or 3·50 millimètres.

Deltocephalus picturatus, *Fieb.*, S. E. D. fig. 23.
Plate LIII., fig. 4.

Deltocephalus Flori, Scott, Ent. Mo. Mag. 1881, p. 66.
,, *picturatus*, Edw. pt. ii. p. 50; Dr. Paul Löw, Synonymie der Cicadinen, Wiener Entomol. Zeitung. ii. 1883, Heft. 2, p. 37.

This insect appears greatly to resemble that last described, but the vertex appears to have the sides less arcuate, and there is a difference in the form of the rusty red spots thereon. The pronotum also is spotless. The elytra are marked much as in *D. repletus*. Legs perhaps are rather darker in the tint, and the black inner streak on the hind tibia is more decided than in *D. repletus*.

"Scarce. Pitlochry, Perthshire. Dunston Common, near Norwich." From Mr. Edwards' cabinet.

Size, 0·13 inch, or 3·50 millimètres.

Mr. J. Scott has placed *D. picturatus* amongst the synonyms of *D. Flori*, Fieb., but he gives no special reasons for so doing. Dr. Paul Löw, however, remarks that these insects are clearly distinct. He admits that the colouring is very similar in both kinds, but that there are differences in the genitalia of the two males. The form of the side plates (*seitenlappen*) of *D. Flori* is not that of *D. picturatus*, and he remarks that the figured details given by Fieber are true to Nature.

He also describes their differences of habitat. *D.*

picturatus haunts principally the plains at the feet of low outlying spurs to the mountains in Lower Austria, and rarely occurs in the mountains; whilst *D. Flori* principally affects the Sub-Alpine regions, and seldom comes down to the lower country. *D. flori* also is known, he says, in Northern Europe, whilst (up to 1883) no record had been made of captures in these latter parts.

Its comparatively recent captures in Scotland and East England, however, now remove this special objection to their identity.

DELTOCEPHALUS COSTALIS, *Fall.* Plate LV., figs. 1 to 1*b*.

Cicada costalis, Fall.
Jassus costalis, Thoms.
Deltocephalus bipunctipennis, Boh.; Fieb., S. E. D. fig. 1; Sahlb.; Edw. pt. ii. p. 57.

Mr. Edwards first recorded the capture of this insect. It was taken by him in September, 1889, in Ranworth marshes, Norfolk, and my figure is drawn from a loan specimen in his collection. It has a close resemblance to *D. punctum*, but there appears to be an additional black spot on the elytron. One of these spots is placed on the first and the other on the fourth apical area.

Colour pale ochreous, and almost white. Elytron rather reddish towards the apex, which has also a darkish margin in juxtaposition with a short crescentic white streak; nervures white. Vertex and pronotum about equal in length, and greenish. Abdomen yellow, with a brown apex. Genital plates of the male at least three times as long as the valve. Hind margin of the female ventral segment, nearly straight.

Size, 0·14 inch, or 3·50 millimètres.

The following slight sketch may be used for a preliminary and superficial grouping of the species comprised in the genus *Deltocephalus*. The remarks more particularly apply to the males of the genus.

A. Elytra wholly or very nearly concolorous, and without ornamentation:—*D. striatus. D. abdominalis. D. striifrons. D. citrinellus. D. Linnei. D. pascuellus. D. Falleni.*

B. Elytra with isolated spots: sometimes these are annular:—*D. sabulicola. D. argus. D. punctum. D. costalis.*

C. Elytra with fuscous-coloured areas:—*D. distinguendus. D. socialis. D. Flori. D. ocellaris. D. ocellatus. D. repletus. D. picturatus. D. pulicaris. D. coroniceps. D. Normani.*

Genus XXXIX.—ALLYGUS, *Fieb.*

Vertex convex, and rounded rather than acute; with the eyes as wide as the pronotum, which last part has the hind border concave. Scutellum large. Abdomen in the males fusiform. Elytra long, and when closed overlapping at their apices, such a closure being made by the folding of a moderate limbus or appendix. Discoidal areas three; apical areas five; but the elytral areas are subject to subdivision. Clypeus long and narrow. Basal joint of the hind tarsus as long as the second and third taken together.

Allygus mixtus, *Fab.* Plate LIV., figs. 1 to 1 *i.*

Cicada mixta, Fab.
,, *reticulata*, Fall.
Jassus mixtus, Fab.; Germ.; Burm.; Flor; Marsh.; Kirschb.; Thoms.; Ferrari, Cicad. Agri. Ligust. 144, with figs.

Jassus reticulatus, H.-Schäff.
Thamnotettix mixta, Sahlb.
Allygus mixtus, Scott; Edw. pt. ii. p. 61.

This is the most plentiful of our British species of *Allygus*, and may be commonly taken on oaks, at Haslemere and other places, throughout the summer and autumn.

It is very variable as to the brown or black speckling of the elytra; sometimes the membrane is deep brown from the frequency of these spots, whilst at other times they show themselves very scantily.

Male. General colour fine ochreous. Vertex rather short, with from four to eight small spots. Eyes brown, pale, or red, according to the age of the insect. Pronotum with a greyish disc-mark, with brown stainings. Scutellum with the mask-like ornamentation, and occasionally with ferruginous spots. Abdomen long and fusiform; brown, with yellow on the segmental edges. Apex pointed and cleft. Elytron more or less covered either with small black punctuations or with larger spots, which on the costa are slightly confluent. Black streaks occur also at the point of the clavus. An oval white spot may be seen at the apices in well-marked specimens. Wings ample, with the anal furcated nervure stouter than the others. All legs spotted pale ochreous, and the hind tibiæ with dark linear stripes. Frons ochreous, and much marked with striæ and spots. Genital processes complex. Plates triangular, and more than twice the length of the genital valve. See fig. 1, *b*, *c*, *d*.

The female is larger, much paler or greyer, and the abdomen thick and cylindrical.

Some varieties are beautifully mottled with cool or else with reddish grey; and when fresh from the pupa they often occur prettily tinged with green.

	Inch.	Millimètres.
Expanse	0·46	11·68
Size	0·19	4·81

Allygus modestus, *Fieb.* Plate LIV., figs. 2 to 2*b*.

Allygus modestus, Fieb.; Scott; Edw. pt. ii. p. 61; Ferrari, fig. 66.
Jassus atomarius, Marsh.

Vertex short, with a fine medial line placed between two other fine lines, inclining outwards from the base. General ground colour of the whole insect pale umber-brown; the entire surface covered with fine and also coarse dark brown punctuations. Elytra with raised shining nervures. Frons brown, with fine brown striations or bars. Clypeus with a streak, dilated at its end, flanked by two others. Base of abdomen of the male white and shining on the under side. Legs streaked and spotted.

Not common, but generally distributed.

Size, 0·27 inch, or 7·00 millimètres.

Allygus commutatus, *Fieb.* Plate LIV., figs. 3 to 3 *b*.

Allygus commutatus, Scott; Edw. pt. ii. p. 60.
Jassus atomarius, Flor; Kirschb.; Thoms.
,, *commutatus*, Ferrari.
Thamnotettix reticulata, Sahlb.

Male. Vertex short, dark brown at the anterior border, without any obvious intermedial line. Eyes and scutellum ochreous. Pronotum dark brown and mottled. Elytron longer than the abdomen, greyish, but ochreous brown at the apex, and irregularly punctured with black. All the legs ochreous, and finely punctured with black. Frons brown and obscurely spotted. Rostrum brown. Rest of the face ochreous.

Female. Larger, and the body less pointed than the male. Colour dirty olive-green. Punctuations indistinct, except on the pronotum, which has a row

of transverse dots on a paler ground colour. Legs greenish olive. Frons yellow, and covered with fine brown streaks.

The ventral plate is deeply notched, within which cavity a rounded tooth with two lobes is situated. The genital valves are large, and the point of the saw projects from them. The pygofer of the male is somewhat complex, and when viewed from behind shows a short pointed caudal process, between the two rounded genital plates; below which the ends of the styles may be seen.

The genitalia thus differ somewhat in form from those of *Deltocephalus distinguendus*.

	Inch.	Millimètres.
Size of male	0·27	6·85
,, of female	0·28	7·10

Rare. Tintern, Norwich, in August.

My figures are from Mr. Douglas's and from Mr. Edwards's collections.

Genus XL.—THAMNOTETTIX, *Zetterstedt*.

Body oblong and dilated. Head with the eyes about as wide as the pronotum. Vertex convex and slightly produced. Ocelli (if visible) equally distant from the eyes as they are from themselves. Pronotum rounded on the anterior margin. Elytra much longer than the abdomen, rounded at their apices, with five apical and three discoidal cells. Appendix ample. Wings veined as in *Allygus*.

This is a genus much involved in its synonymy. In some species the elytra are more lanceolate, and thus approximate to the next genus.

Thamnotettix cruentata, *Panz.* Plate LV., figs. 2 to 2 *b*.

Cicada cruentata, Panz.; Fall.
Jassus cruentatus, Flor; Marsh.; Kirschb.; Thoms.
Thamnotettix cruentatus, Zett.; Sahlb.; Scott; Ferrari; Fieb.; Edw. pt. ii. p. 68.

Head, pronotum and scutellum warm ochreous-yellow, and abundantly speckled with blood-red dots. Vertex round in front, with or without two roundish black spots. Eyes small. Pronotum with two pale greyish spots, darker within. Abdomen black, with orange sides and segmental edges. Apex tufted. Elytra creamy-ochreous, rounded at the tips. Limbus not much developed. The blood-red dots are most crowded at the base of the elytra, and they principally follow the direction of the nervures. Legs setose; colour pink or reddish. The hind tibia with a single stripe. First tarsal joint about equal to the second and third taken together. Wings ochreous-grey; nervures black.

For its size, and for its colour, this is a striking insect, and it is easily recognised.

Local, but not rare.

	Inch.	Millimètres.
Expanse	0·42	10·67
Size of body	0·18	4·57

Thamnotettix prasina, Fall. Plate LI., figs. 3 to 3 *c*.

Cicada prasina, Fall.
Jassus simplex, H.-Schäff.
,, *prasinus*, Flor; Marsh.; Kirschb.; Thoms.
Aphrodes sulphureus, Curt.
Athysanus prasinus, Scott.
,, *simplex*, Reut.; Ferrari.

Thamnotettix confinis. T. tinda.
,, *stupidula*, Zett.; Sahlb.
,, *prasina*, Zett.; Edw. pt. ii. p. 63.

Rather variable in general colour; some specimens having ochreous-yellow elytra, whilst others have elytra of a rich chestnut-brown, with dark sienna venations and rounded apices. Limbus small. Head, pronotum and scutellum pale brown, and almost spotless. Wings purple-grey, with strongly-marked black neuration, the anal vein being much thickened. Legs warm sienna-brown, without spots or streaks. Mr. Edwards notes that the legs are striped and spotted. Abdomen uniformly of a brown-black, and shining. Some specimens show three small dashes on the vertex, and a festooned stripe on the pronotum, and also faint basal spots on the scutellum.

The pygofer of the male is of a complex, and perhaps unique, nature. The genital valves are large, and produced beyond the apex of the abdomen. The caudal process, the œdeagus, the styles and the lateral processes are singular in appearance when seen in profile; their details are noted in fig. 3 *c*.

My specimens were taken in "Mesopotamia," amongst the marshy land between the Rivers Isis and the Cherwell, at Oxford. The insects seem to affect bogs and damp meadows in early summer.

THAMNOTETTIX SPLENDIDULA, *Fab.* Plate LVI., figs. 1, 1 *a*.

Cicada splendidula, Fab.; Fall.
Jassus splendidulus, Flor; Marsh.; Kirschb.
Thamnotettix splendidula, Sahlb.; Scott; Fieb.; Edw. pt. ii. p. 68.

Male. General colour ochreous, pale yellow or pale orange, shining and bronzy. Vertex pointed with two

large and two smaller black oblong spots on the disc. Pronotum about one-third longer than the vertex, with four pale brown vertical bands. Scutellum with two basal triangular marks and the mask-like punctuation. Frons densely barred with brown. Rostrum black. Abdomen fusiform, pointed, and black, with golden-yellow segmental edgings and apex. Legs pale orange. Hind tibiæ flavo-setose, each with a fine inner stripe. Elytra long and iridescent, with paler neurations. The areas in some specimens are deeply, in others obsoletely, marked with rich fuscous-brown. Wings subhyaline and greyish.

Some specimens are more gaily marked than others.

Fairly common at Haslemere and other places.

Size, 0·22 inch, or 6·59 millimètres.

THAMNOTETTIX DILUTIOR, *Kbm.* Plate LVI., fig. 2.

Thamnotettix dilutior, Kirschb.; Edw. pt. ii. p. 64.
Athysanus dilutior, Scott.

General colour pale ochreous, with pale brownish indistinct tintings in the neighbourhood of the elytral areas. Vertex short and spotless. Pronotum with a greyish patch on the disc. Scutellum with two dots and the usual transverse line. Abdomen pale yellow, with numerous brown and greyish marks, which are broadest at the sides. Apex pale. Legs yellowish, generally concolorous and spotless. Wings ample, with coarse brown nervures. Sometimes there is a black spot at the apex of the clavus.

Rather common on the oaks round Haslemere.

	Inch.	Millimètres.
Expanse	0·46	11·68
Body	0·19	4·80

THAMNOTETTIX TORNEELLA, *Zett.* Plate LVI., figs. 3 to 3 *a*.

Thamnotettix Torneella, Zett.; Sahlb.; Fieb.; Edw. pt. ii. p. 68.
,, *punctifrons*, Scott.
Jassus Torneellus, Flor.
,, *punctifrons*, Marsh.

Mr. Marshall found this insect common in bushes in Epping Forest; but, with the exception of this and Mr. G. Norman's record, who beat the insects out of heather at Forres, its capture has rarely been noted.

The specimen figured, and lent to me by Mr. Douglas, shows a considerable resemblance to some varieties of *T. subfuscula.* The principal distinction appears, indeed, to be in the markings of the vertex and the pronotum; the former part showing two transverse lines between the eyes, with two other minute spots on the apex; the pronotum has two dashes on its anterior edge, on a line below the eyes.

Size, 0·19 inch, or 5·00 millimètres.

THAMNOTETTIX STRIATULA, *Fall.* Plate LVI., figs. 4 to 4 *a*.

Cicada striatula, Fall.
Thamnotettix striatula, Zett.; Edw. pt. ii. p. 67.
Jassus striatulus, Flor; Marsh.; Kirschb.; Thoms.
,, *corniculus*, Marsh.
Limotettix striatula, Sahlb.
Athysanus striatulus, Scott; Ferrari.

All the upper side greyish ochreous. Vertex with two triangular brown marks at the apex, followed by two interrupted lines between the eyes, which last organs are spotted. Pronotum about one-third longer than

the vertex, and covered with coarse black punctuations. Scutellum with a yellowish, irregular, cruciform stripe. Legs pale umber-brown, spotted, and showing an inner stripe. Frons warm brown-ochre, crossed with numerous confluent streaks. Two marks (ocelli ?) appear above the insertion of the antennæ.

This insect appears to be rare, though Mr. Marshall took it "rather commonly," in July, 1886, on *Pteris aquilina*, at Rannoch.

Size, 0·16 inch, or 4 millimètres.

THAMNOTETTIX ATTENUATA, *Germ.* Plate LVI., figs. 5 to 5 *a*.

Jassus attenuatus, Germ.
,, *rupicapra*, Marsh.
Deltocephalus croceus, Kirschb.
Thamnotettix attenuata, Scott; Ferrari; Fieb.; Edw. pt. ii. p. 70.

Rather small. Ochreous-yellow, sparsely blotched with orange-red. Vertex arcuate, grey, with two red stains on the disc, and with very small dashes near the apex. Pronotum grey, also stained with orange and red. Scutellum with two red basal marks. Elytra pointed, with brown apices, and with sundry dark spots, principally on the clavus, and obscure streaks. Legs pale, with brown points. Abdomen brown.

The female is larger and more obtuse in shape, with the elytra finely punctured. The end of the pygofer is yellow and cleft.

Found sparsely on grasses in dry places.

Size, 0·16 inch, or 4 millimètres.

THAMNOTETTIX PLEBEJA, *Fall.* Plate LVII., figs. 3—3*b*.

Cicada plebeja, Fall.
Jassus plebejus, H.-Schäff.; Thoms.
Athysanus plebejus, Flor; Kirschb.; Scott; Ferrari.
,, *Schenkii*, Kirschb.
Thamnotettix plebejus, Zett.; Sahlb.; Edw. pt. ii. p. 66.

Rather large, robust. Head, pronotum and scutellum pale ochreous; the former with a greyish spot, within which, or at its base, a V-shaped line occurs (but not always). The pronotum may be concolorous, or else dotted with spots, or marked by disjointed lines. Abdomen black, with rusty blotchings and a band above the apex. Legs yellow, spotted, and streaked. Elytra broad and round, with pale wide lines indicating the seats of the nervures. The areas obscurely filled with brown or with fuscous. Wings ample.

The female is paler, with smaller punctuations. Apex of pygofer yellow, cleft, and tufted.

In many respects *T. plebeja* resembles the next described species. Mr. Edwards says that this insect "occurred in profusion, in July and August, amongst long grasses, in a garden at Norwich, but I have seen no other examples." I have myself only taken a single specimen at Haslemere, which I have figured; but the figure of the female is from Mr. Douglas's collection.

	Inch.	Millimètres.
Expanse	0·54	13·70
Body	0·26	6·60

THAMNOTETTIX VARIEGATA, *Kbm.* Plate LVII., figs. 2, 2*a*.

Athysanus variegatus, Kirschb.; Ferrari (?).
,, *irroratus*, Scott.
Thamnotettix variegata, Kirschb.; Sahlb.; Edw. pt. ii. p. 65.

Very like the preceding insect, but darker, and more covered with brown punctures.

Male. Head pointed, with a brown inter-ocular streak, which is sometimes disjoined. Two black punctures near to the anterior border of the pronotum. Frons yellow and black. Pronotum semilunar in form, marked with numerous small dashes and spots, as also is the scutellum. Abdomen brown, with a large opening on the pygofer showing a minute cauda. Legs streaked. Elytra long and rounded at the apices, with yellow veinings, indicating the fuscous brown areas. Wings large and grey. The sutural nervures forked and very stout.

The female is paler and less highly ornamented than the male. The last ventral segment emarginate, and provided with a medial central tooth.

Some examples are very dark in colour, and then the pale neurations on the elytra become almost obsolete.

	Inch.	Millimetres.
Expanse	0·36	9·14
Body	0·15	3·81

Not common, but occasionally taken at Haslemere; also found on the Kentish coast, and in other places.

THAMNOTETTIX SUBFUSCULA, *Fall.* Plate LVII., figs. 1, 1*a*.

Cicada subfuscula, Fall.
Jassus subfusculus, H.-Schäff.; Germ.; Flor; Marsh.; Kirschb.; Thoms. *J. pectoralis*, Burm.
Athysanus subfusculus, Scott; Ferrari.
Thamnotettix subfuscula, Zett.; Sahlb.; Edw. pt. ii. p. 64.

Colour uniformly yellow-brown or ashy-yellow. Elytra with pale yellow neurations. The suture of the clavus sometimes dark brown. Vertex roundish

and almost spotless. Frons black, with a yellow medial linear stripe, dilated towards the clypeus. Pronotum rather clouded on the disc; sometimes marked with a few anterior dark brown stains. Scutellum with or without the usual basal brown spots. Elytra fulvous-yellow, with paler neurations. Abdomen black or brown, and somewhat shining. Legs dirty yellow, with an inner brown stripe.

A specimen in Mr. Douglas's cabinet has a yellow frons, with feeble brown striations and a yellow medial space.

Male specimens sometimes occur thickly speckled with fuscous, but most examples are concolorous.

May be taken in numerous places, amongst damp herbage, as early as April; and they may also be beaten out from various trees, under which they resort for shelter.

Haslemere, and elsewhere. It appears to be scattered also over the whole of Finland during June, July, and August.

	Inch.	Millimètres.
Expanse	0·42	10·67
Length of body	0·20	5·04

Genus XLI.—LIMOTETTIX, *Sahlb.*

Body elongated. Vertex obtusely pointed, sublunate, and convex above. Frons nearly straight-sided. Rostrum short. Antennæ rather long. Pronotum transverse, "lateribus teretibus." Elytra longer than the abdomen, distinctly furnished with a limbus, which overlaps when the wings are closed. Wings as in *Thamnotettix*. Legs with four setose edges; the inner one strongly spinose.

This genus has much in common with *Thamnotettix*, but in a general manner it may be said to show the elytra longer, more lanceolate, and less rounded at the

tips. Sahlberg divides his twenty-three species into two divisions, *viz.*, those having four subapical areas in the elytra, and those having five such areas.

Species are common in the north of Europe, and some kinds are very hardy. They show much activity even during the winter months, some affecting the sea-shores and crouching at the roots of grasses which grow on the summits of high and windy chalk cliffs, even at the very edges of deep snow-drifts.

LIMOTETTIX SULPHURELLA, *Zett.* Plate LVIII., figs. 1 to 1*d*.

Cicadula sulphurella, Zett.
Cicada virescens, Fall.
Jassus virescens, Flor; Marsh.; Kirschb.; Thoms.
Thamnotettix virescens, Scott; Fieb.
,, *sulphurella*, Ferrari.
Limotettix sulphurella, Sahlb.; Edw. pt. ii. p. 74.

General colour rufous-yellow, or else brimstone-yellow, with a greenish tinge. Vertex obtusely produced, sometimes with two minute ocellus-like points. Eyes large and brown. Disc of the pronotum greenish. Scutellum yellow, with or without spots. Clypeus rather dilated at the apex; genæ with two small spots. Antennæ much longer than half the body. Elytra almost concolorous yellow, long, and narrow in the middle. Limbus obvious, but not large. Apical areas four. Wings ample and hyaline, with the sutural and adjoining nervures brown and very strong. Legs yellow, with rufous setæ. Abdomen of the male warm black, with rufous side-edging, and with a broad yellow spot above the pygofer.

The live insects are more highly coloured than dry and mounted specimens. Nevertheless, in life, individuals vary much both in shade and apparently in the number of the visible ventral rings.

Common throughout the summer. Taken on Worcester Beacon, Romney Marsh, Haslemere, &c. Common also throughout Scandinavia and Finland.

	Inch.	Millimètres.
Expanse	0·38	9·64
Length with wings	0·19	5·00

LIMOTETTIX SEXNOTATA, *Fall.* Plate LVIII., fig. 2.

Cicada sexnotata, Fall.
Cicadula sexnotata, Zett.; Scott; Ferrari; Fieb.
,, *frontalis*, Scott.
Tettigonia sexnotata, Germ.
Eupteryx sexnotata, Curt.
Jassus sexnotatus, H.-Schäff.; Flor; Marsh.; Kirschb.; Thoms.
Limotettix sexnotata, Sahlb.; Edw. pt ii. p. 76.

Exceedingly variable as to its markings. Sahlberg, indeed, notices sixteen different varieties, chiefly connected with the variegation of the head and pronotum. On account of the occasional suppression of these spots on the vertex, it is very difficult to decide whether examples belong to this or the following species. Some examples, also, are nearly hyaline and transparent as to their elytra, whilst others are nearly opaque from the suffusion of colour on the membranes.

Small. General colour yellow or yellow-grey. Vertex with two roundish black spots at the base, followed by two longer spots in advance. Eyes reddish brown. Two other spots occur just above the frons, which are partially seen from the dorsal view of the insect, completing the number six. Frons greenish yellow, with faint brown transverse bars; the sutures at the genæ black. Pronotum almost spotless. Abdomen dark

brown, either with one or two orange streaks above the pygofer. Legs yellow. Hind tibiæ with many black punctures. Elytra concolorous, opaque yellow, with a brownish limbal edge. Two longitudinal brown dashes occur on each clavus. Wings hyaline, with brown nervures.

Very abundant. Thousands were taken from under the leaves of the hawthorn (*Cratægus*), in the public gardens at Great Malvern, in August. Common also at Haslemere and other places.

	Inch.	Millimètres.
Expanse	0·26	6·60
Body	0·12	3·00

LIMOTETTIX SEPTEMNOTATA, *Fall.* Plate LVIII., figs. 4 to 4*b*.

Cicada septemnotatus, Fall.
Cicadula septemnotatus, Zett.; Marsh.; Kirschb.; Thoms.
Limotettix septemnotata, Sahlb.; Edw. pt. ii. p. 75.

Head, pronotum and scutellum yellow. Vertex rounded, with two spots above the anterior edge of the pronotum, and two dark brown and larger spots at the apex, Eyes brown. Pronotum sometimes with a faint horse-shoe mark on the disc, caused by the confluence of the dark basal marks on the scutellum : this is seen through the partially transparent pronotum, Elytron with a yellow or orange-yellow membrane. Smoky at the apex, sometimes with two indistinct yellow streaks, proceeding from the base. Wings hyaline. Frons yellow, with brown bars, and seen often with two more brown spots near the eyes, and one additional spot just above the clypeus ; which thus make up the number seven. Like the previous species, these spots are not constant in number. Abdomen black, with

broad lateral yellow stripes. On the under side the last three abdominal rings are greyish white. Saw-case of the female black. Legs orange, wiih a strong brown line on the hind tibia.

Sahlberg notices three varieties.

Widely distributed, and found as far north as Christiania. I have examples from Huddersfield, and from Ranworth in Norfolk. Marshes and wet fields.

Length with wings, 0·14 inch or 3·5 millimètres.

LIMOTETTIX QUADRINOTATA, *Fab.* Plate LVIII., fig. 3.

Cicada quadrinotata, Fab.; Fall.
Jassus quadrinotatus, Flor; Marsh.; Kirschb.; Thoms.
,, *strigipes*, Thoms.
Cicadula quadrinotata, Zett.
Aphrodes spilotocephala, Hardy.
Thamnotettix quadrinotata, Scott; Fieb.
Limotettix quadrinotata, Sahlb.; Edw. pt. ii. p. 73.

Colour fine yellow or greenish-yellow. Vertex produced and rounded, with two large oval brown spots between the eyes, and two smaller spots near the apex. Pronotum semilunate, with a greenish stain on the disc. Scutellum yellow, with three fine transverse dashes. Elytra long, fuscous at the tips. Nervures yellowish. Thorax black, with yellow sides. Legs yellow. Hind tibia with a fine line, and with long yellow setæ on the edges.

There are several varieties; one with a black spot between the antennæ, all the legs sparsely spotted, and with a pale fuscous elytral stripe. This latter insect appears to be *Cicadula strigipes* of Fieber.

Common on many kinds of grasses from June to October.

Length with wings, 0·17 inch, or 4·75 millimètres.

LIMOTETTIX STRIOLA, *Fall.* Plate LIX., figs. 1 to 1*c*.

Cicada striola, Fall.
Jassus striola, H.-Schäff.; Flor; Marsh.; Kirschb.; Thoms.
Jassus frenatus, Germ.
Athysanus striola, Scott; Ferrari.
Limotettix striola, Sahlb.; Edw. pt. ii. p. 71.

Colour dirty yellow. Vertex short and obtusely pointed, with two small black dots at the base, followed by a long straight brown transverse line between the eyes; also on the apex two brown bordering spots or else a single one. Pronotum and scutellum, in the male, finely and numerously punctate with brown; the female is less so marked. Elytron of the male broadly striped and spotted with brown. The female is larger; the elytra less variegated and of a shining honey-yellow colour; sometimes it shows a fine wavy scarlet line above the striated band of the vertex. Hind legs spotted and banded. Frons of the male black, with a yellow middle stripe. Thorax and abdomen black, with yellow segmental margins.

"Locally common in damp places." My figures are from specimens lent to me by Mr. Douglas.

Length, 0·17 inch, or 4·50 millimètres.

LIMOTETTIX INTERMEDIA, *Boh.* Plate LIX., figs. 2 to 2*a*.

Thamnotettix intermedia, Boh.; Scott; Fieb.
Jassus intermedius, Thoms.
Limotettix intermedia and *lunifrons*, Sahlb.; Edwards, pt. ii. p. 72.

The only example I have seen is from Mr. Douglas's collection, which I figure and describe.

Female. General colour ochreous-yellow. Frons elongated and somewhat narrow. Vertex with four small dark points at the apex. Eyes pale brown. Pronotum semilunate and almost spotless. Scutellum with indications of two basal spots, and below these a fine transverse line. Elytron flavo-hyaline, with pale nervures. Abdomen black, with the sides narrowly yellow. Legs yellow. Hind tibia with a brown stripe and ochreous setæ. Frons ochreous, with two small points on the tempora just above the antennal insertion; between which points there occurs a brown undulating line. Antennæ long. Edges of the clypeus and the genæ brown.

Size with the elytra, 0·19 inch, or 5·00 millimètres.

Taken in Scotland at Loch Greenin. September.

Limotettix variata, *Fall.* Plate LIX., figs. 3 to 3*b*.

Cicada variata, Fall.
Jassus fumatus, H.-Schäff.
,, *variatus*, Marsh.; Kirschb.; Thoms.
,, *sexnotatus*, var., Flor.
Cicadula variata, Scott; Fieb.
Limotettix variata, Sahlb.; Edw. pt. ii. p. 76.

Body somewhat linear; yellow or ochreous-yellow. Vertex rounded or obtusely angular. Eyes partially brown. Two large, somewhat triangular, brown spots at the base, with two small spots at the apex. Scutellum semilunar, with an irregular greyish stain on the disc, occasionally seen with small brown punctuations. Scutellum with large basal spots and a fine transverse line. Examples occur in which the scutellum is brown with the exception of two yellowish spots. Elytron either fine yellow or whitish hyaline. Appendix ample and margined with brown.

The well-marked specimens have a broad dark bar spreading from the costa towards the clavus, and

another bar nearer to the apex, which crosses to the posterior margin of the corium. When the wings are closed these bands form often an elegant lozenge-shaped mark, with a pale central interior.

This species is very variable, both as to tint and markings.

Legs yellow or else pale, and without any streak on the hind tibiæ. Abdomen brown, with yellow segmental bands and a black apex. All beneath yellow.

Taken on oaks during July and August, but it is said to be scarce in Britain.

Size with wings, 0·16 inch, or 4·00 millimètres.

My figures are from examples in the cabinets of Mr. Douglas and Dr. A. Piffard.

In many respects this insect seems to resemble *Gnathodus* in markings. It may be regretted that there should be such similarity of names in these closely-allied genera. Thus we have *Thamnotettix variegata* and *Limotettix variata*; and, again, *Thamnotettix attenuata* and *Limotettix antennata*. The adoption of an old synonym, however, might produce further confusion.

LIMOTETTIX NIGRICORNIS, *Sahlb.* Plate LX., figs. 1 to 1*c*.

Thamnotettix nigricornis, Scott.
Limotettix nigricornis, Sahlb.; Edw. pt. ii. p. 73.

Elongated, narrow, golden yellow in colour. Vertex obtuse, punctured on each side, between the eyes, by two larger and two smaller spots. Eyes grey. Antennæ black and much longer than half the body. Elytra subpellucid, each with a fuscous oblique band; nervures yellowish. Legs yellow, streaked and setose.

The male was unknown to Sahlberg; but Mr. Douglas sent me an example of *L. nigricornis*, which I figure and believe to be of that sex. It is smaller and more taper than the female, with five obscure brown

vertical bars on the pronotum, and two small black punctures on the elytron—one at the apex of the clavus, and another on the lower margin of the corium. The frons is yellow and without bars.

Length, 0·22 inch, or 5·50 millimètres.

Scarce. Taken by Dr. Power at Colton, Somersetshire, and "also by Blatch."

LIMOTETTIX ANTENNATA, *Boh.* Plate LX., fig. 2.

Thamnotettix antennata, Boh.
,, *frontalis*, Scott; Fieb.
Jassus antennatus, Marsh.; Thoms.
,, *longicornis*, Kirschb.
Limotettix antennata, Sahlb.; Edw. pt. ii. p. 74.

Female dirty ochreous-yellow. Vertex with two small round spots between the eyes, and two faint dashes before the apex. Pronotum with an irregular brown discal stain. Elytra warm ochreous, with pale nervures, and a tendency to show an obscure brown claval streak. Thorax black. Abdomen ferruginous, with yellow bands. Legs tinged with red, more particularly on the tibiæ. Hind tibia with a narrow black inner stripe, and a black dash on each tip of the femur. Setæ long and orange-red in colour. Frons tinged with red, with two large oblong spots; the sutures black. The antennæ long, nearly as long as the body.

Jassus antennatus, Flor, is greenish yellow. There is a dark variety of the male with fuscous stains in the elytral areas.

Affects the coarse herbage in marshes and damp meadows.

Externally this insect much resembles *L. intermedia*, but the antennæ are distinctive by their length.

Length, 0·23 inch, or 6·00 millimètres.

LIMOTETTIX METRIUS, *Flor.* Plate LX., fig. 3.

Jassus metrius, Flor.
Deltocephalus metrius, Fieb., S. E. D. fig. 58; Sahlb.; Scott; Edw. pt. ii. p. 74.

Male. Deep yellow or honey-yellow. Vertex blunt and tinted at the apex with warm brown. Scutellum slightly stained at the sides, and marked with a faint angular cross stripe. Elytra concolorous yellow, with whitish nervures, and a blackish suture to the clavus. Areas sometimes margined with fuscous. Wings hyaline. Legs pale. The hind tibiæ with conspicuous black points on the outer side. Female dirty yellowish-white.

Size with wings, 0·16 inch, or 4·00 millimètres.

Mr. Edwards says it is not uncommon amongst the long herbage of the marshes in East Norfolk, and at Ranworth, &c. "In the structure of the male genitalia it is a true *Limotettix;* though the crown is somewhat Deltocephaloid." Sahlberg accordingly describes it under the genus *Deltocephalus*, stating that in North Europe it nestles under different kinds of *Carex*, in September. Examples of this and many other species may be found preserved in the Museum of the University of Helsingfors.

LIMOTETTIX CROCEA, *H.-Schff.* Plate LX., figs. 4 to 4*e*.

Jassus croceus, H.-Schäff.
,, *attenuatus*, Marsh.
Deltocephalus oxypterus, Kirschb.
Thamnotettix crocea, Scott; Ferrari; Fieb.; Edw. pt. ii. p. 69.

General colour of a fine ferruginous yellow. Vertex rather prominent but obtuse, with two dark apical marks (interocellar ?) and three orange-red vertical streaks. Pronotum with six such streaks. Scutellum pointed, with four other streaks. Abdomen broad, and pointed at the apex, the last segments being white; and in the female showing the black tip of the saw-case. Sides of the abdomen and the edges of the segments obscurely red. Elytra rather browner, very acute at their apices, each of which is ended by a short brown dash. The areas are varyingly filled with fuscous-brown. Three small oblong dashes mark the marginal border of the clavus. Nervures whitish, or else pale fulvous. Wings hyaline and finely iridescent; nervures reddish brown. Legs greyish yellow or brown. Inner side of the hind tibia often with a narrow line and coarse outer bristles. Fore legs finely setose. Under side brown, with orange lateral foldings to the abdominal segments. Saw-case of the female small and projecting.

The jointed caudal process rises from within a deep cavity in a conical termination: this aperture is oval in form. Two peculiar roundish plates are seen above the cauda; partially hidden by the edges of the said opening.

The female is larger, but less brightly coloured, than the male. The frons is yellow, and shows a faint barring, interrupted in the middle.

The pointed character of the elytron, with its five apical cells and small limbus, is characteristic of the species; and this character certainly removes it from the ordinary forms of *Thamnotettix* under which some have included it.

The insect is common in most grassy places. Taken at Albury, Hertfordshire, at Haslemere, and in the Isle of Wight. I found it exceedingly common on the windy heights above Ventnor, after the great "blizzard" of March, 1891. They were quite active at the edges of the deep snow-drifts in the hollows of the cliffs: they

must have been very hardy to stand the low temperature of such a severe winter.

The live insect is a very interesting and brilliantly coloured object if viewed under a good microscope, with a sufficiently reflected light.

	Inch.	Millimètres.
Expanse	0·34	8·62
Size of body and wing	0·21	5·50

Genus XLII.—GNATHODUS, *Fieber.*

Fieb., 'Neue Gattungen und Arten in Hemipteren,' p. 504, with details in figure.

Body long, anteriorly obtuse. but narrow behind. Vertex short, about one fourth the length of the pronotum. Elytra much longer than the body, overlapping at their apices. "Corio vena post costali in punctis dissoluta, cubitali furcata" (Sahlb.). No transverse veins. Limbus large. Third wing-nervure joined to the branch of the second wing-nervure by a short transverse nerve. First wing-nervure not branching to the marginal vein.

Gnathodus punctatus, *Thunb.* Plate LXI., figs. 1 to 1 *a.*

Cicada punctata, Thunb.; Fall.
Eupteryx clypeata, Curt.
Cicadula punctata, Zett.
,, *spreta*, Zett.
Jassus punctatus, H.-Schäff.; Flor; Marsh.; Kirschb.; Thoms.
Gnathodus punctatus, Fieb.; Sahlb.; Ferrari; Edw. pt. ii. p. 77.

Linear, attenuated towards the tail. Opaque yellowish green or ochreous, with greyish white streaks. Vertex very short. Eyes yellow, with pig-

mental spots. Pronotum acute-semicircular, with a nearly straight posterior edge, slightly emarginate. An irregular brown streak on each side. Three reddish yellow parallel streaks pass from the upper edge of the crown, and these are continued down one-half of the pronotum. Scutellum whitish, with three red streaks above and two below. Elytron hyaline at the tip, with a brown spot at the point of the clavus. Four or more spots cross the corium, and sometimes these tend to make an oblique bar. Limbus rather wide. Apical cells four, large and irregular in form and size. Discoidal cells two, and unequal in length. Wings large, with a peripheral border; the first nervure not forked to this border. Abdomen cylindrical, brown, with yellow-bordered segments and side edges. Genital valves of the male small, and obtusely rounded at their apices. Legs pale yellow or greyish. Hind tibiæ with brownish tarsal points. Hind femora with black knees and greyish in tint. Setæ yellow. Face pale yellowish. Frons grey, and marked by eight obscure spots. Ocelli distinct, and placed at the upper margin of the frons. Antennæ rise from shallow foveæ, below greyish patches. Genæ semicircular, and bordered with brown streaks. Clypeus oval. Rostral sheath short.

The above synonyms are those given by Dr. Sahlberg, who notes two varieties the characters of which mostly relate to colour-differences and markings.

This insect appears to be the sole European species of the genus as yet described. How far it differs generically from *Limotettix* I am unable to say. The figures of the wings in Sahlberg's 'Ofversigt' do not show any very clear departure from that genus; but as he has not given a lettered nomenclature to the nervures of the wings he engraves, his descriptions are not very easy to follow.

As to the habitat of this insect, Mr. Edwards says, "Obtained by sweeping in summer, and beating firs in winter and spring; and not very common."

As before noted, this insect at first sight appears to be very like to *Limotettix variata*.

General Remarks on the Genera of the Cicadæ already described.

At the close of this description of the Deltocephalidæ, a review of certain facts brought to notice in the pages of the previous, and in those of the present, volume, may here be conveniently discussed. Materials for a study of the foregoing genera, and the numerous species of the tribe of insects for which I have suggested the title Tettigidæ, seem here to offer themselves, and they may perhaps decide how far I have been justified in placing these non-stridulating insects amongst the true Cicadæ.

It may here be urged that the presence or absence of stridulating organs is not sufficient of itself to separate species which in other respects very generally agree. Even the consideration of wing-neuration, at one time so strongly advocated, cannot alone decide this question.

Differences between the extreme examples furnished by the Centrotidæ and the Deltocephalidæ, to say nothing of the lower forms of the Typhlocybidæ, shortly to be described, seem to be greater than between the stridulating genus *Cicadetta* and examples furnished by *Macropsis*, *Cixius*, *Pediopsis*, *Thamnotettix*, &c. Apart from the marked differences in size, one can hardly doubt, from their general aspect, that these insects have close relations to known families.

If *Cixius* and *Macropsis* are not admissible amongst Cicadinæ, there seems to be no alternative to placing them in a separate group, which nevertheless appears to be quite unnecessary.

Morphologically I cannot separate these genera with any sharpness; and therefore I assign to the Tettigidæ an equal tribal position amongst Trimerous Homoptera to that taken by the Psyllidæ and Aphidæ amongst Dimerous Homoptera.

In all the genera, indeed, of this family of insects, certain organs seem formed on similar types. The

face, with its frons (almost always striated, indented, or barred transversely with brown), is a marked characteristic, which tends, we may say, to a clear identification of the whole group.

The genitalia, likewise, are apparently framed on the lines of a common type, whether we consider the most highly specialised examples of Cicada or those of the more simple Typhlocybidæ.

The deeply chambered caudal process, with its variously shaped style, may be well studied in *Issus*, *Cixius*, *Liburnia*, *Idiocerus*, and *Deltocephalus*, up to the end of *Typhlocyba*. The variously shaped male genital styles may be followed through *Delphax* to *Gnathodus*, and the curiously recurved, flagelliform, intromittent male organ, may be seen exampled in the figured details of Plates XII., XIV., XVIII., and others.

The serrated ovipositor, with the complicated laminæ which form its sheath, obtains throughout the whole group from *Cicada* to *Zygina*. Although this is the last genus of the series, and the species are less differentiated, the insects contained within it are by no means lacking in interest either as to form, colour, or ornamentation.

The tasks of revising species and the collation of synonyms are tedious, and attended also with responsibility. Outward appearances may be misleading, and the repeated appeal to the microscope for details, though necessary, is often laborious.

John Scott has noted the interesting fact that some species, and more particularly those of the Delphacidæ, show such similarity that they may be broken up into what he calls "parallel pairs," and that this similarity is kept up both in the Macropterous and Brachelytrous forms (see Ent. Mo. Mag. vii. p. 75). The resemblance between several forms is indeed so close that, except for certain divergences in the details of the pygofer, one well-defined species can with difficulty be separated from its mimic. How far such mimicry may prove to be protective will be the result of subsequent investigation.

PLATE XLIX.

Deltocephalus abdominalis. (Page 52.)

Fig. 1.—Imago. The elytral nervures are almost lost in the chitin.

Deltocephalus striifrons. (Page 53.)

Fig. 2.—Imago of the female.
Fig. 2 *a*.—Face and frons of the male.

Deltocephalus pascuellus. (Page 54.)

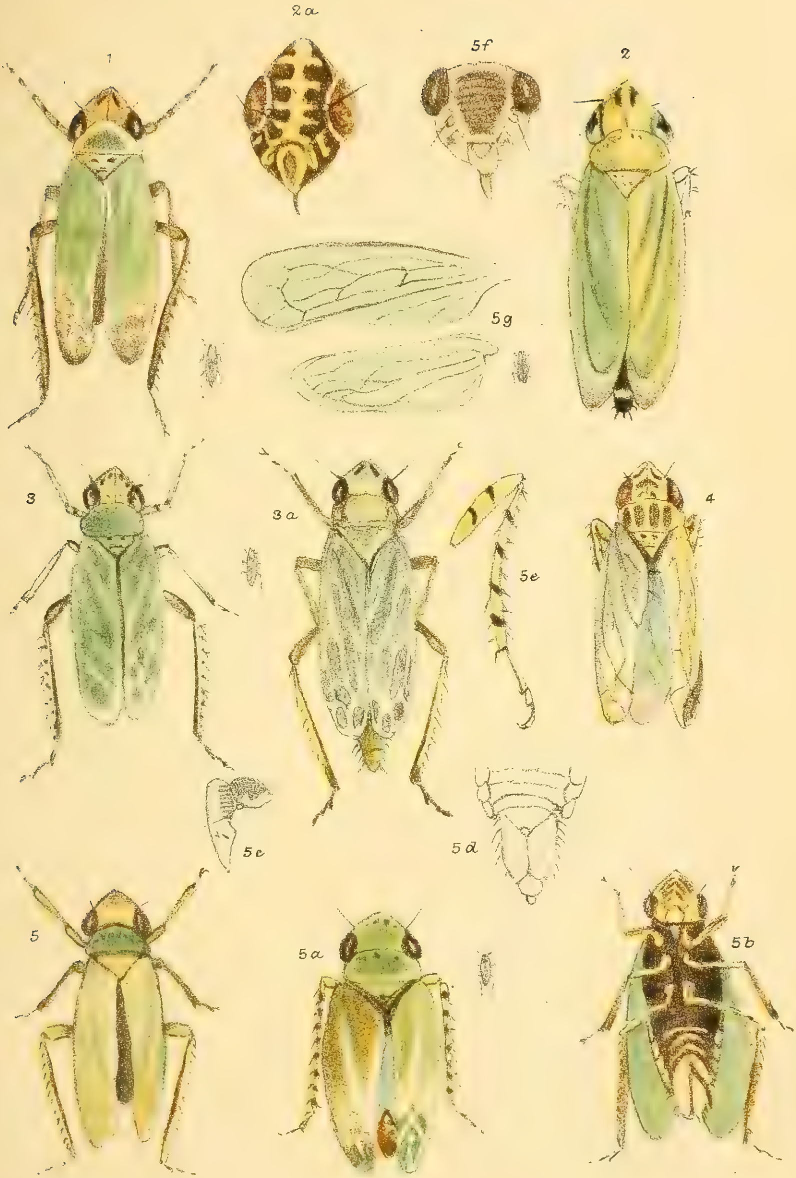
Fig. 3.—Imago of the male.
Fig. 3 *a*.—Imago of the female, with the elytral areas more clouded.

Deltocephalus Linnei. (Page 55.)

Fig. 4.—Imago.

Deltocephalus citrinellus. (Page 56.)

Fig. 5.—Imago of the female.
Fig. 5 *a*.—Variety, more obtuse in form.
Fig. 5 *b*.—Under side of the female, showing the serrated ovipositor protruding beyond the genital plates.
Fig. 5 *c*.—Face and frons seen in profile.
Fig. 5 *d*.—Under side of the male, showing the genital valve and genital plates; also the point of the caudal process.
Fig. 5 *e*.—The hind femur, tibia, and tarsus of the same, with its spots and long first tarsal joint.
Fig. 5 *f*.—Face and frons of the same.
Fig. 5 *g*.—Elytron and wing of the same. The wing is abnormal in its venation.



G.B.B. del. et lith.

West, Newman chromo.

PLATE L.

Deltocephalus argus. (Page 57.)

Fig. 1.—Imago. In this specimen the spots are somewhat annular in shape.

Fig. 1 *a*. — Head and pronotum of the same, in which the eyes are only partly filled with pigment.

Fig. 1 *b*. — The terminal abdominal segment of the male, showing the perforated caudal process, protruding from a short cylindrical tube with plates. This tube emerges from below the notch of the pygofer.

Deltocephalus Falleni. (Page 57.)

Fig. 2.—The macropterous imago.

Fig. 2 *a*.—The brachelytrous imago.

Deltocephalus sabulicola. (Page 58.)

Fig. 3.—The female with expanded wings.

Fig. 3 *a*.—The male with closed wings.

Deltocephalus punctum. (Page 59.)

Fig. 4.—Imago showing the elytral spots.

Fig. 4 *a*.—Frons and face of the same.

Deltocephalus pascuellus. (Page 54.)

Fig. 5. — Terminal segment of the female. The parts have been digested in aqueous potash so as to render the details visible and transparent. The cauda is seen above the plates which enclose the saws.

PLATE L.

G.B.B. del. et lith.

West, Newman chromo.

PLATE LI.

Deltocephalus distinguendus. (Page 60.)

Fig. 1.—Imago of the male. Details of the pygofer may be seen in Plate LII., fig. 3.
Fig. 1 *a*.—Imago of the female.
Fig. 1 *b*.—Larval form of the same.
For other details see Plate LII., figs. 3, 3 *a*.

Deltocephalus coroniceps. (Page 62.)

Fig. 2.—Imago of the same.

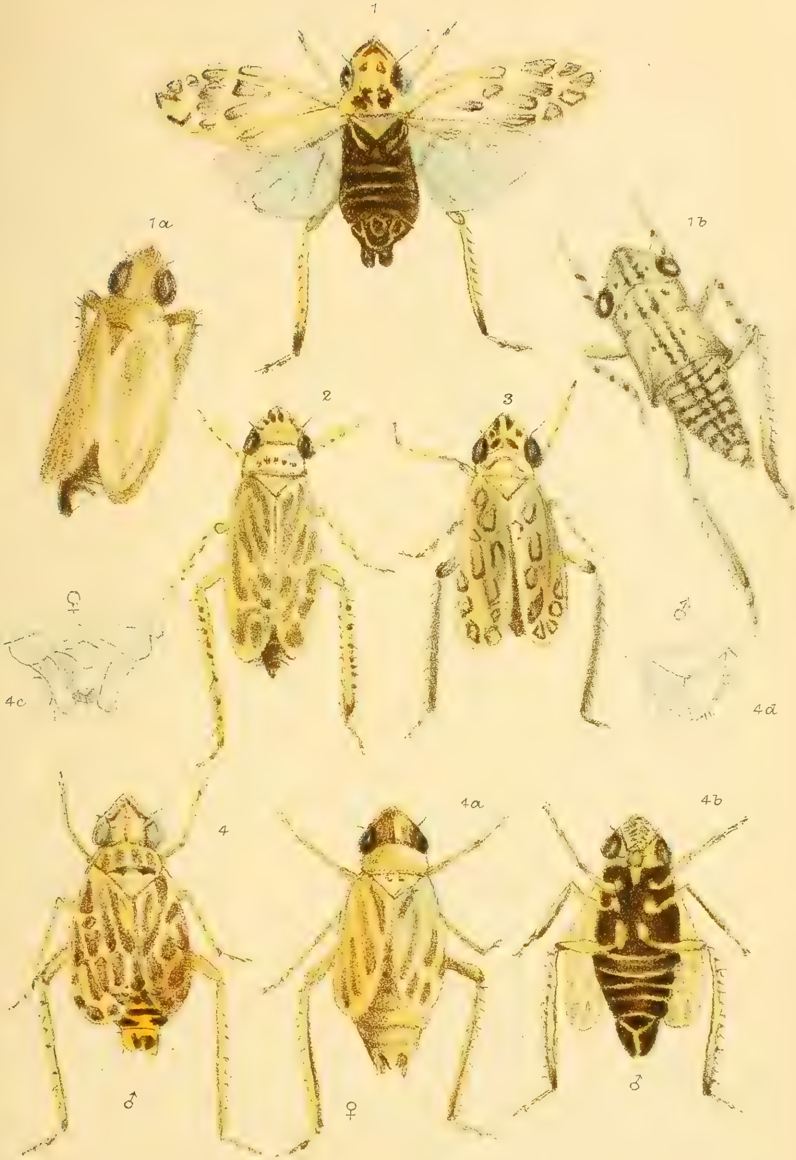
Deltocephalus Normani. (Page 63.)

Fig. 3.—Imago of the same.

Deltocephalus socialis. (Page 64.)

Fig. 4.—Imago of the male, with its short elytra.
Fig. 4 *a*.—Female, with the dentate pygofer.
Fig. 4 *b*.—Under side of the male.
Fig. 4 *c*.—Upper aspect of the pygofer of the female, showing the caudal process between the genital plates.
Fig. 4 *d*.—Upper view of the pygofer of the male. The genital plates cover the styles and intromittent organ.

PLATE LI.



G.B.B. del. et lith.

West, Newman chromo

PLATE LII.

Deltocephalus pulicaris. (Page 65.)

Fig. 1.—Imago with its short elytra and half-developed wings.

Fig. 1 *a*.—Another variety seen in profile.

Fig. 1 *b*.—Elytron and wing. The areas of the former organ are by no means constant in number or form.

Fig. 1 *c*.—Hind tibia and tarsus of the same.

Deltocephalus Flori. (Page 66.)

Fig. 2. — Imago viewed in profile. The red spots on the head and pronotum vary in disposition and number.

Fig. 2 *a*.—Larval form of the same.

Fig. 2 *b*.—Elytron enlarged from an unpublished drawing by Scott.

Fig. 2 *c*.—Face and frons of the above insect.

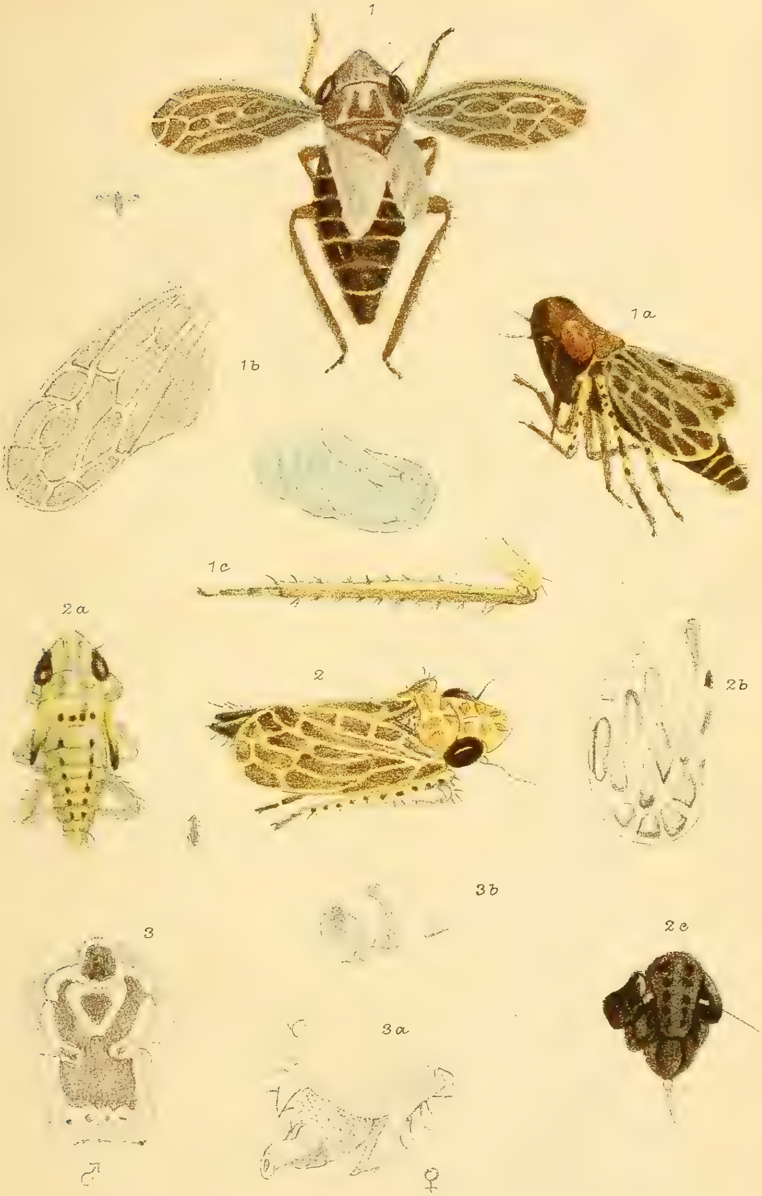
Deltocephalus distinguendus. (Page 60.)

Fig. 3.—Part of the male pygofer, showing a small style-like process above the cauda. To the walls of this chamber two prehensile (?) processes are attached, which apparently divide the opening. The upper part may represent the œdeagus of Dr. Sharp, as seen in some Heteroptera.

Fig. 3 *a*.—Part of the female pygofer, showing in profile the caudal process, and possibly the anal end of the alimentary canal.

Fig. 3 *b*.—The rectal cauda of the last figured, much magnified. As this organ is transparent, indications of an internal canal may be traced. See Plate LI., fig. 1.

PLATE LII.



G.B.B. del.et lith.

West,Newman chromo

PLATE LIII.

DELTOCEPHALUS OCELLARIS. (Page 67.)

Fig. 1.—Imago. The whitish veinings of the elytra show only the seats of the nervures, and are not the nervures themselves.

Fig. 1 *a.* —Face and frons. Half profile.

Fig. 1 *b.*—Figure of elytron, *from an unpublished drawing by Scott.* The dark marks indicate the areas only.

Fig. 1 *c.*—Wing of *D. ocellaris.*

Fig. 1 *d.* — Upper side of abdomen.

Fig. 1 *e.*—Male. Genital plates from the under side.

Fig. 1 *f.*—Profile view of the same.

Fig. 1 *g.*—Under side. *The last two figures are after Scott.*

DELTOCEPHALUS OCULATUS. (Page 68.)

Fig. 2.—Imago of the same. In Mr. Edwards' cabinet.

DELTOCEPHALUS REPLETUS. (Page 68.)

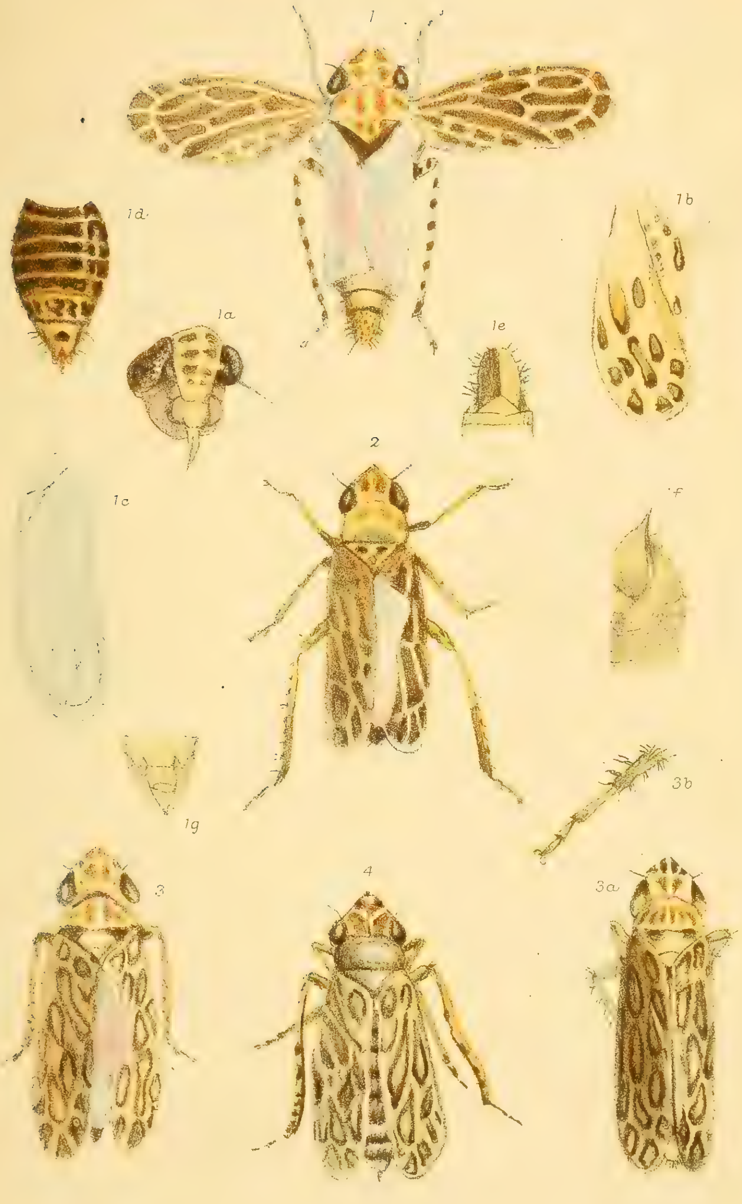
Fig. 3.—Imago.

Fig. 3 *a.*—Variety, more linear in form.

Fig. 3 *b.*—Hind tarsus of the same.

DELTOCEPHALUS PICTURATUS. (Page 69.)

Fig. 4.—Winged form, from Mr. Edwards' cabinet. Some of these specimens of rare insects are from loan examples fixed on card. Thus it happens that some do not show the setæ on the hind tibiæ, which doubtless they originally had during life.



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West, Newman chromo.

PLATE LIV.

Allygus mixtus. (Page 71.)

Fig. 1. — A fine and well-marked specimen of the male, with white tips to the elytra.

Fig. 1 *a*.—A specimen of the female, only recently excluded from the pupa.

Fig. 1 *b*.—Elytron of the same, showing the nervures. The punctuations are not drawn.

Fig. 1 *c*.—Front view of part of the pygofer of the male.

Fig. 1 *d*.—Upper side of the female pygofer.

Fig. 1 *e*.—Fore leg, showing the dark stripe and bandings.

Fig. 1 *f*.—End of the tarsus of the front leg, with its pulvilli.

Fig. 1 *g*.—End of the hind leg, with tarsal joints.

Fig. 1 *h*.—Face and frons.

Fig. 1 *i*. —Antenna with a bristle at the base of the setal joint.

Allygus modestus. (Page 73.)

Fig. 2.—Imago of the male.

Fig. 2 *a*.—Face and frons of the same.

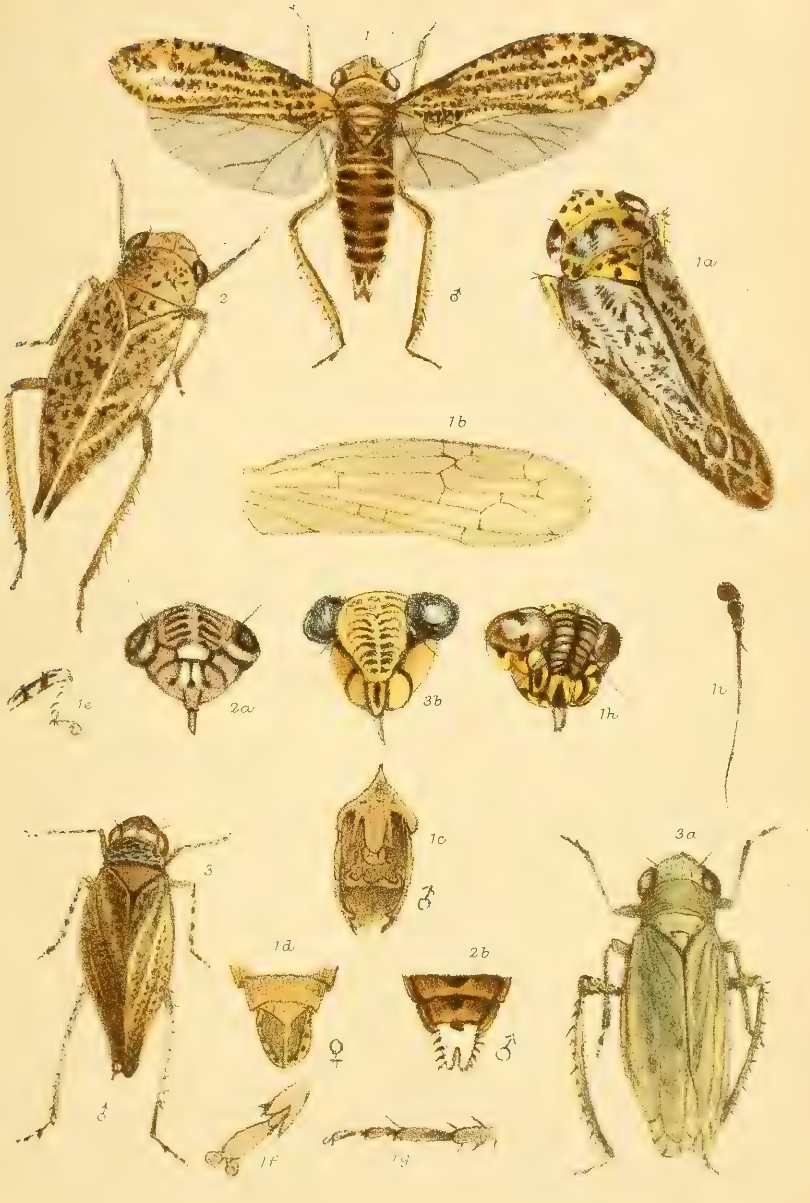
Fig. 2 *b*.—Upper view of the abdominal apex of the male.

Allygus commutatus. (Page 73.)

Fig. 3.—Imago of the male.

Fig. 3 *a*.—Imago of the female, much larger.

Fig. 3 *b*.—Face and frons of the same.



G.B.B. del. et lith.

West, Newman, chromo.

PLATE LV.

DELTOCEPHALUS COSTALIS. (Page 70.)

Fig. 1.—Imago, from Mr. Edwards' collection.

Fig. 1 *a* and Fig. 1 *b*.—Side view of the pygofer and the style, after Fieber.

Fig. 4. — The profile view of the pygofer of *D. punctum*, here placed for comparison with *D. costalis*.

THAMNOTETTIX CRUENTATA. (Page 75.)

Fig. 2.—Imago with expanded elytra.

Fig. 2 *a*.—Tarsal joints of the hind foot; each joint is finely spurred.

Fig. 2 *b*.—Antenna of the same.

THAMNOTETTIX PRASINA. (Page 75.)

Fig. 3.—Imago showing the long genital plates of the male.

Fig. 3 *a*. — Two elytra from the same insect. The neuration differs on each side.

Fig. 3 *b*.—Profile view of the curious organs of the pygofer. The figure shows the cauda, the œdeagus, and the infra-lateral processes.

Fig. 3 *c*.—The genital plates of the male seen from below.

PLATE IV.

G.B.B. del. et lith

West, Newman chromo.

PLATE LVI.

Thamnotettix splendidula. (Page 76.)

Fig. 1.—Imago, with its fusiform abdomen.
Fig. 1 *a*.—Face, frons, and coxæ of front legs.

Thamnotettix dilutior. (Page 77.)

Fig. 2.—Winged female, with its rounded vertex and obtusely formed body.

Thamnotettix torneella. (Page 78.)

Fig. 3. —Imago, with its linear elytra and body.
Fig. 3 *a*.—Dorsal view of the head and pronotum.

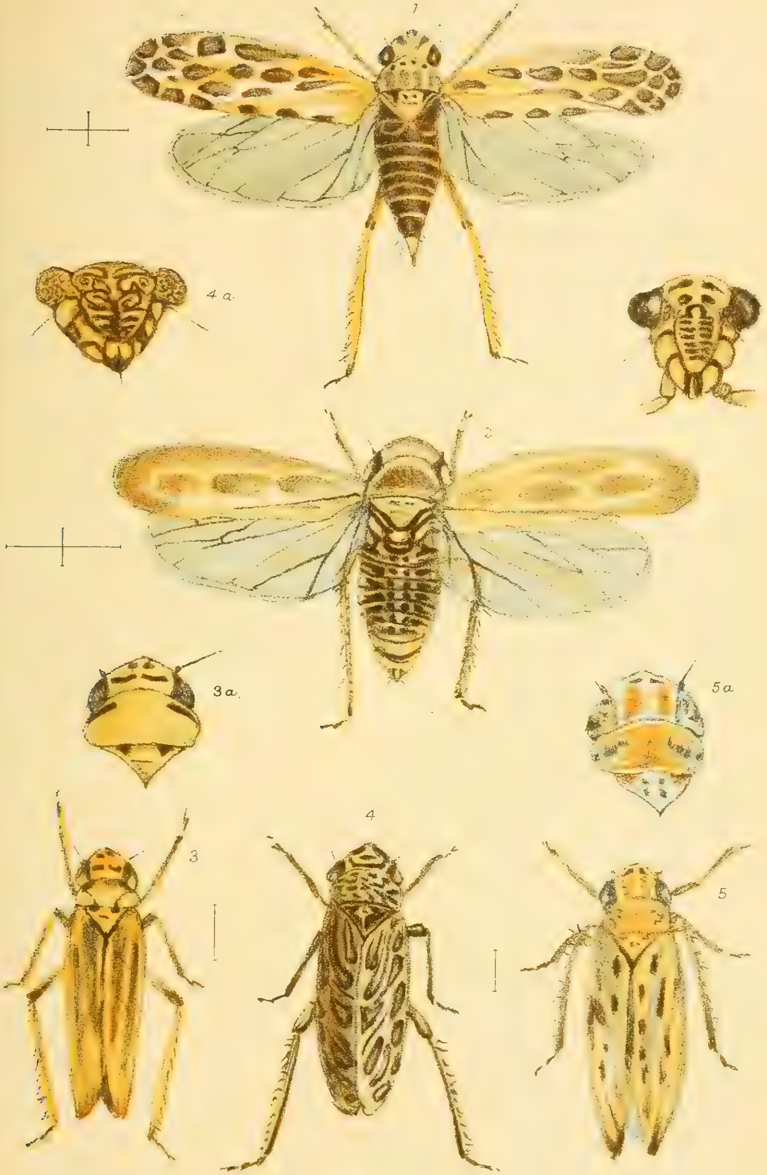
Thamnotettix striatula. (Page 78.)

Fig. 4.—Imago of the same.
Fig. 4 *a*.—Face and frons.

Thamnotettix attenuata. (Page 79.)

Fig. 5.—Imago, from Mr. Douglas's cabinet.
Fig. 5 *a*.—Dorsal view of the head and pronotum.

PLATE LVI.



G.B.B. del. et lith.

West, Newman chromo.

PLATE LVII.

THAMNOTETTIX SUBFUSCULA. (Page 81.)

Fig. 1.—Imago. The strength of the sutural nervures assists in spreading the rather voluminous wings of this genus.

Fig. 1 *a*.—Frons and face of the same insect.

THAMNOTETTIX VARIEGATA. (Page 80.)

Fig. 2.—The imago. The upper part of the pygofer, with its oval opening, may be seen as viewed from the back.

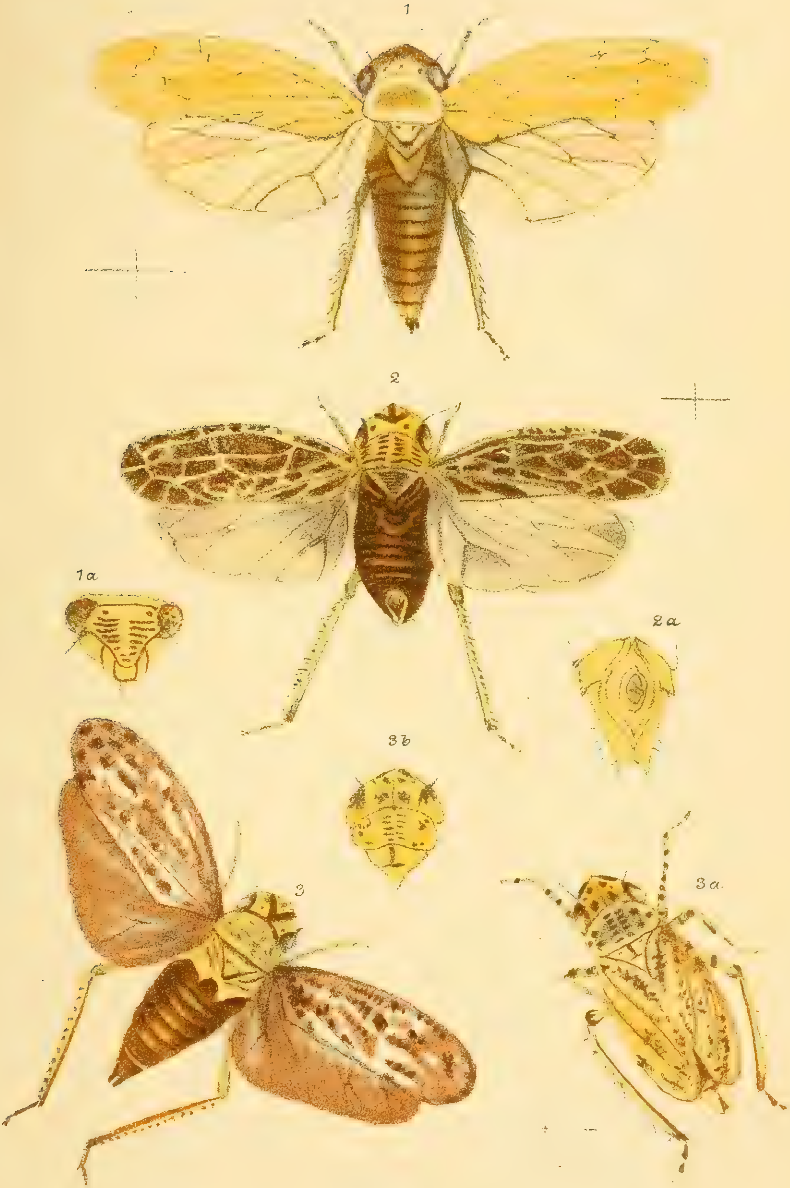
Fig. 2 *a*.—The pygofer more magnified, showing the small caudal style.

THAMNOTETTIX PLEBEJA. (Page 80.)

Fig. 3.—The imago, with its obscurely blotched elytra and emarginate post-scutellum.

Fig. 3 *a*.—The same insect with its closed wings.

Fig. 3 *b*.—Face and frons of the same.



G.B.B. del. et lith.

West, Newman chromo.

PLATE LVIII.

LIMOTETTIX SULPHURELLA. (Page 83.)

Fig. 1.—Imago with its plain unicolorous elytra.

Fig. 1*a*.—The same with folded wings. In this specimen the ocelli may be traced, and two basal spots on the scutellum.

Fig. 1*b*.—Abdomen of the same.

Fig. 1*c*.—The greenish abdomen of the variety *L. virescens*.

Fig. 1*d*.—The under side of the female pygofer, with *l* the lateral plates, *v* the valve, and *s* the partly protruding saw.

LIMOTETTIX SEXNOTATA. (Page 84.)

Fig. 2.—The expanded imago, with its spotted head. The form of these spots is not constant.

LIMOTETTIX QUADRINOTATA. (Page 86.)

Fig. 3.—Imago with closed elytra.

LIMOTETTIX SEPTEMNOTATA. (Page 85.)

Fig. 4.—Imago with closed elytra. Here the spots on the vertex are confluent. More often, however, five spots appear above, on the head; and two at the upper portion of the frons.

Fig. 4*a*.—Face, frons, and rostrum of the same.

Fig. 4*b*.—Under side of the abdomen of the male, with its grey terminal joints.

Fig. 4*c*.—Antenna with fine setæ, rising from a frontal cavity.

B. B. del. et lith.

West, Newman chromo.

July, 1891.] [In Eight Parts.—Part VII.

MONOGRAPH

OF THE

BRITISH CICADÆ,

OR

TETTIGIDÆ,

ILLUSTRATED BY MORE THAN

Four Hundred Coloured Drawings.

BY

GEORGE BOWDLER BUCKTON, F.R.S., &c.,

COR. MEMB. ACAD. NAT. HIST. OF PHILADELPHIA,

MEMB. DE LA SOC. ENT. DE FRANCE.

"Sole sub ardenti resonent arbusta Cicadis."

"The small becomes the dreadful and immense."

VOLUME II.

London

MACMILLAN AND CO.

AND NEW YORK

1891

Price Eight Shillings

Heteropterous bugs are often noted for their abominable odours, but the Tettigidæ hitherto known are innocent in this particular. It is yet to be tested if any of these forms are distasteful to birds or other enemies, and, if such be the case, whether they are imitated by other species. *Philœnus exclamationis* might easily be mistaken for *Deltocephalus;* and, indeed, all the larvæ of the British Aphrophoræ, in certain respects, show outward resemblance to *Deltocephali*.*

Dr. Puton names, in his list, no less than ninety-four species of European *Deltocephali*,—many of these on the authority of Dr. Fieber, whose type specimens are, in a great measure, lost. Dr. Sahlberg and also Mr. T. Edwards, for specific purposes, lay some stress on the proportional lengths of the head, as measured against the length of the pronotum.

The difficulty of using such measurements is great, particularly as dimensions may apparently differ if seen perspectively on different planes. Moreover, the head is in a small degree retractile below the fore margin of the pronotum. Particulars of such measurements need not, however, be disregarded, although it is almost impracticable in such minute insects to eliminate all errors of oblique vision under the microscope.

I have endeavoured to draw with some accuracy the neuration of many of the foregoing species; but in several cases I have been obliged to obtain information from dry carded specimens. Some of these examples were at the time of mounting unique, or they were specimens of rare species. This circumstance rendered their dismemberment for detail-drawing undesirable.

Even when the elytra have been raised from their overlappings, the wings below are so intimately folded and embraced by their own nervures, that

* The canary bird will devour almost any number of the larvæ of *Philœnus spumarius*, and as the spume itself does not appear to be distasteful to it, it does not act as a deterrent through any bad flavour.

they are more commonly torn through the efforts made to spread them than they are successfully opened out for correct drawing.

It may be noted that wing-nervures act much as distenders, somewhat similarly to the ribs of an umbrella. They also partly determine the courses of the folds. During the insect's lifetime the ribs have a considerable spring, and the stout character and strength of the furcated submarginal vein (*Nahtrippe* of Fieber) principally causes the first and chief plication. In the *Deltocephali* and the Typhlocybidæ this submarginal wing-vein is markedly developed, and the same is seen also in *Paramesus*, *Thamnotettix*, *Limotettix*, &c.

The elastic spring of the wing-nervures, under the control of the living insect, is observable in the familiar sight of a *Coccinella* or a *Staphylinus* packing up its voluminous wings under its small elytra, after the end of a flight. Similar action occurs, but with marvellous rapidity, after the leaps of the small Typhlocybidæ and other groups of the Tettigidæ.

A departure from the normal arrangement has not yet been shown in any special neuration of the males and the females; but the fact that insects of other families sometimes show examples of a male morphology on one side and a female morphology on the other, will make us wonder less at a few departures from the strict type to be noted on my plates. I have more attempted to draw what the microscope seemed distinctly to show, than to make such drawings conform to what we might expect from details usually furnished by the genus. To prepare for such drawings, wings may be floated out on water, and deposited on glass microscope slides. Unfortunately these dissections are, when stored dry, liable to the growth of mycelium and mould, even when mounted in glazed dry cells. If, on the other hand, Canada balsam be run in, the wings are made so transparent that their venation becomes almost invisible.

The ideal of a species will long be a subject of thought to the biologist. Numerous have been the definitions offered, but none can be said tersely to express that which, in one sense, may be considered only as an abstract thought. Sir Joseph D. Hooker, speaking of plants, defines a species "as a collection of constant varietal characters taken from any organ or part." Another authority says, "When some general resemblance is combined with differences greater than such as our experiences warrant us in attributing to mere breed, we are obliged to regard the individuals as belonging to different species. But inasmuch as this conclusion depends on the lack of evidence to the contrary, and is far short of what is conceivably possible to obtain, the tendency must be towards the multiplicity of species." *

Thus it happens that one thinker who lays too much stress on minor details will form (say) forty-five species out of our British brambles, whilst another, of greater powers perhaps of generalisation, will reduce these species to five alone. Botanists are still divided as to the number of species that should be given to our British willows. Still all biologists admit that species do exist; and that study can no more be carried out without their recognition, than can arithmetic be worked without its integers.

At one time Darwin almost seemed to ignore species as scientific entities, in such a phrase as "a species is an arbitrary assumption convenient to the systematist"; and indeed his theory supposes that "all species are descended from one progenitor." Nevertheless he qualifies his above assertion by remarking that "they (species) do not at any time or period present an inextricable chaos of varying and intermediate links. Yet common is the error to make one out of the other."

A highly suggestive and important illustrated memoir, on the structure of the terminal segment in some small Hemiptera-Heteroptera, has comparatively

* Sir G. Stokes, Proc. Vic. Inst., 1883.

lately been published by Dr. David Sharp (Trans. Ent. Soc. Lond., part iii. 1890). Numerous figures are given in my present Monograph, for exemplifying similar parts of the males in the Tettigidæ, which are members of the Homoptera. These parts, although varying greatly in different species, may in a measure be homologously collated, and shown to be related to each other, species with species. It will be seen that the suggestions Dr. Sharp puts forward, as to the Heteroptera, in great measure apply to these groups of the Homoptera. His observations really help us to bring out of their apparent intricacies the complex details of the pygofer so often alluded to in foregoing pages, and to show us that they are not unique or confined to the Heteroptera.

Until, however, the corresponding parts of the Typhlocybidæ have been figured, it will be premature to discuss such a difficult subject as the significance of the parts, or hazard anything as to the possible function they may take in the economy of the insects.

TYPHLOCYBIDÆ.*

This section of the Tettigidæ is sharply separated from the others by certain characters of the elytra and wings. The former organs are longer than the body, and, with the exception of the genus *Alebra*, there is no limbus or appendix to fold over the suture. These elytra so cover the wings that they make the insect appear cylindrical in form whilst seated at rest. The ocelli are very rarely visible. The frons is long and triangular.

The species, as a rule, are small, but under the microscope they are often elegantly and brightly coloured.

Some kinds are very abundant, and. through their numbers in certain seasons, do some small injury to

* The application of this term is not obvious; but it may have reference to the obscure cubical markings on the elytra of some species, or else to the squarish form of the vertex.

our crops, by reason of their irritating punctures on the leaves, which injuries result in small yellow spots, caused by the destruction of the parenchyma. Thus our potatoes and mangold leaves sometimes suffer, and also the ferns in our hot-houses, through similar attacks. Various bushes and forest trees form food and shelter for several species. Occasionally the white-thorn (*Cratægus*) is tenanted by thousands of small *Typhlocybæ*, and these cover the clothes of anyone who shakes a bough overhead. Noticeable amongst trees forming their habitats may be named the hazel, the elm, the poplar, willow, alder, and rose tree; some of which trees have their special and particular species.

I have followed Mr. J. Edwards' lead as to dividing this group into seven genera. Dr. Sahlberg and other systematists add to these *Compsus*, *Notus*, *Cicadula*, and *Erythria*, or at any rate they make them equivalent, if not additive, to the former genera.

The genera are separable by attention to certain characteristics in the elytral and alar neuration; and by an examination of the complicated details and appendages of the sexual organs.

Of the seven genera composing the Typhlocybidæ it may be conveniently noted that *Alebra*, *Dicranura*, *Kybos* and *Chlorita* show their wings each furnished with a marginal vein, complete to the first fork of the anal nerve. The three remaining genera—*Eupteryx*, *Typhlocyba*, and *Zygina*—have no marginal nervure.

All these genera have three radial nervures, but in the first section these end in the marginal nervure; and in the second section they end at the periphery of the wing.

Genus XLIII.—ALEBRA, *Fieb.*

Vertex slightly curved, with its fore edge running parallel to the curved hind-margin. Ocelli distinctly visible. Pronotum rather wider than the head.

Scutellum about equal in length to the pronotum. Frons a long triangle. Rostral sheath small. Elytron longer than the abdomen, with a narrow but distinct limbus, and showing three long apical cells.

First and second radial wing-nervures running to the margin, and connected by a short transverse vein. Third radial vein forked before reaching the periphery of the wing.

Genital plates broad, but the genital valve is wanting in the male.—Sahlberg.

ALEBRA ALBOSTRIELLA, *Fall.* Plate LXI., figs. 2 to 2*d.*

Cicada albostriella, Fall.
,, *elegantula*, Zett.
Typhlocyba albostriella, H.-Schäff.; Flor; Kirschb.
T. elegantula, *discicollis*, *fulveola*, Kirschb.
T. Wahlbergi, Boh. *T. eximia*, Hardy.
Cicadula elegantula, Zett.
Eupteryx fasciata, Curt.
,, *albostriellus*, Marsh.
Compsus albostriella, Sahlb.
Alebra albostriella, Leth.; Ferrari; Fieb.; Edw. pt. ii. p. 79.

Vertex, pronotum, and scutellum white. Pronotum with two perpendicular brown streaks. Abdomen long, taper, brown, and obscurely tinged with yellow on the dorsum. A triangular pale patch occurs on the penultimate, and an oval patch on the last abdominal segment. Elytra greenish yellow, with fumose apices, and more or less orange at their bases. Clavus reddish. Legs either white or pale yellow; hind tibiæ with black points. Frons white or pale yellow, with six obscure dots near the vertex.

The antenna springs from an oblong process at the corner of the eye.

Var. α.—Head brown. Pronotum white, with two

ovoid yellow spots. Elytron white, with two red streaks, which are broad at their upper bases and tapering at their apical points. Wings greyish, with brown veining.

Var. β.—Elytron yellow. Clavus red, with one long red stripe.

This rather strikingly marked insect is not uncommon at Haslemere. Taken as far north as Stockholm.

	Inch.	Millimètres.
Expanse of wings	0·29	7·10
Length of body and wings	0·13	3·50

Alebra Wahlbergi, Boh., Sv. Ak. Handl. 42. Plate LXI., fig. 3, and Plate LXII., figs. 1 to 1*b*.

Alebra albostriella, Edw., pt. ii., p. 79.

Head whitish. Frons all yellow. Abdomen of female flat, with a projecting saw-case. Colour brown, but reddish at the apex. Legs pale yellow; hind tibiæ finely punctured with brown. Corium of the elytron yellow at the base, but hyaline at the apex. A faint black bar crosses the disc near to the base, and a broader dark bar occurs across the middle of the same. Clavus with a white stripe, but otherwise coloured red by a deposit of pigmental grains (see figure). The under side is all yellow.

Expanse of wings, 0·30 inch, or 7·62 millimètres.

My figure of *A. Wahlbergi*, on Plate LXII., is drawn from a fine insect beaten out of a birch tree at Tyntesfield, near Bristol. This insect differs so much from descriptions of *Alebra* yet given, that I was at first inclined to consider it new to Science. Since then I have found three undoubted examples of *A. Wahlbergi* in Mr. Douglas's cabinet, and they accord with my Bristol insect.

As I am not aware of the reasons for regarding *A. Wahlbergi* as a mere variety of *albostriella*, I venture to

think that Bohemann's species is a good one, and so I retain it.

Genus XLIV.—DICRANEURA, *Hardy*.

Vertex obtusely angular. Elytron longer than the body. Nervures of the corium nearly parallel. Apical areas four. Limbus wanting. First and second wing-radials united before reaching the marginal vein, which latter is complete. Third radial nervure forked, and united by a short transverse vein with the second at about its middle.

This genus is equivalent to *Notus* and *Erythria* of Fieber. The genitalia of the males are complex. The elytral neuration is almost lost or invisible in some of the species. The two forked nervures in the wing give a meaning to the name of the genus.

Dicraneura citrinella, *Zett.* Plate LXII., figs. 2 to 2*b*.

Cicada citrinella, Zett., Faun. Ins. Lap., 536, 36.
Typhlocyba citrinella, H.-Schäff.
,, *forcipata*, Flor; Kirschb.
,, *gracilis*, Zett.
Notus citrinellus, Sahlb.; Ferrari.
,, *Schmidti*, Leth.; Ferrari; Fieb.
Dicraneura citrinella, Edw. pt. ii. p. 81.

Vertex rounded. Pronotum and scutellum concolorous, smoky yellow. Abdomen black and obscurely marked with brown. Pygofer of the male grey, with large and strong genital plates, each surmounted by a black horn-like tooth. Caudal chamber or cellule and its process yellow. Elytron smoky yellow. Nervures indistinct, with an indication of a white semicircular costal mark. Wings very delicate and finely punctured. Legs yellow.

Edwards says "Hind tibiæ with a row of distinct black points," but these are not always to be seen.

Sahlberg gives a description, at some length, of the external genital parts of both male and female.

Foxley Wood, Norfolk. My figure is from a specimen in Mr. Douglas's cabinet.

Length with wings, 0·14 inch, or 3·50 millimètres.

Dicraneura mollicula, *Boh.* Plate LXIII., figs. 1 to 1*e*.

Typhlocyba mollicula, Boh.
,, *facialis*, Flor.; Kirschb.
Notus molliculus, Sahlb.; Ferrari; Fieb.
,, *facialis*, Leth.
Dicraneura mollicula, Doug.; Edw. pt. ii. p. 82.

This insect occurs of various shades of green or greenish yellow. Sometimes it is dirty yellow, or else it has an orange tint.

Abdomen black, with yellow edges to the rings; or with the upper rings brown, the middle shining black, and the apical rings yellow. Elytron greenish or fumose-yellow, with hyaline tips. Wings smoky, sometimes iridescent, with coarse brown nervures. The post-scutellum is large, and much overhangs the abdomen. Legs wholly yellow. Tibiæ without spots. Fore-tarsal joints not obviously trimerous. Ventral plate of the female large, broad, and emarginate. Pygofer of the male complex, with broad genital plate, large caudal chamber and process, accompanied by two long black spines or styles. The saw of the female is often exserted, and forms a sickle-like blade below the abdomen.

Common in many places. Huddersfield and Wakefield, Yorkshire; and also at Haslemere. May to February.

	Inch.	Millimètres.
Expanse	0·25	6·35
Body	0·13	3·30

Mr. Edwards describes the penis to be like the claw-joint of a *Carabus*.

A variety occurs whose elytra are covered, except towards the tips, by a yellowish meal, and with faint crescentic marks on the costa. It hybernates under heath roots. I have taken such numerously and very active in February, when the snow was on the ground.

Dicraneura similis, *Edwards*. Plate LXIII., figs. 2 to 2 *b*.

Very similar in size and colour to *D. citrinella*, from which it is best distinguished by the male genitalia. Mr. Edwards cannot separate the females of the two species by any character. I give the following description of two specimens I have received from him:—

Colour yellow or greenish. Vertex deltoid, with a smoke-coloured apex. Abdomen brown, with greenish transverse strokes down the dorsum. The pygofer of the female comprises an oval caudal chamber, having an internal crescentic wall, enclosed by an outer oval wall. My figure shows details which include a cylindrical tufted cauda. The under side all yellow, with the abdomen more ferruginous in colour. Nervures of the elytra indistinct.

I have not met with the male; but Mr. Edwards gives some outlines of its peculiarly hooked penis, and its pincer-like genital plates (see Ent. Mo. Mag. xxi. p. 229, and Trans. Ent. Soc. *l. c.* pt. 2, p. 81, Pl. iii. fig. 17).

Size of body and wings, 0·14 inch, or 3·50 millimètres.

Not unfrequent on wet commons at Stanton Strawless, Norfolk.

DICRANEURA ARMATA, *mihi*. Plate LXIII., figs. 3 to 3*a*.

Head deltoid; eyes black. Pronotum with fore border pointed; the hind border nearly straight. Scutellum with three longish spots disposed "mask-like." Abdomen of the female very long, dark brown, each segment edged broadly with yellow. The last three sometimes much dilated, and ending with a broad plate and cauda, below which two large genital valves enclose the saw-apparatus; this usually is disengaged, and carried below like a large black sickle. Elytron pale orange darker at the base, and furnished with three strong and darker subparallel nervures, united by four transverse nervures reaching to the margin. Wings grey, with brown nervures. All the legs ferruginous-yellow, without black points.

This insect does not agree with any description that I have seen. It cannot well be *D. aureola* of Fall., the elytra of which are yellow-green; but it partly agrees, perhaps, with *D. pygmæa* of Douglas, a single male of which was taken in Darenth Wood, and up to this time has been unique.

The golden yellow tint of the elytron suggests the possibility of identity with *Cicadula orichalcea* of Zetterstedt; but, failing proof of such, I provisionally name this insect *D. armata*, from the extensive and the highly developed saw-apparatus of the female.

Five examples of this insect were taken in midsummer at Haslemere.

	Inch.	Millimètres.
Expanse	0·24	6·00
Body only	0·14	3·50

DICRANEURA FLAVIPENNIS, *Zett.* Plate LXIV., figs. 1 to 1*d*.

Cicada flavipennis, Zett.
Typhlocyba flavipennis, Flor; Kirschb.
Eupteryx flavipennis, Marsh.
Notus flavipennis, Sahlb.; Leth.; Ferrari; Fieb.

General colour yellow. Vertex deltoid, which, with eyes, pronotum and scutellum are concolorous and unspotted. Frons uniformly yellow. Abdomen fusiform, dark brown, with yellow segmental edgings. Female caudal chamber yellow, with a blunt ciliated process and projecting lower genital plates. Legs ochreous, with fine black points, from which the setæ proceed. Elytron rather paler towards the apex, and with a fumose border; nervures invisible. Wings very delicate and pale; nervures very indistinct. The scutellum and post-scutellum are rather abnormal in form.

	Inch.	Millimètres.
Expanse	0·27	7·00
Body	0·14	3·75

Common amongst damp grass and Carices, at Ranworth, Norfolk, and other places.

DICRANEURA VARIATA, *Hardy*. Plate LXIV, fig. 2.

Typhlocyba citrinella, Flor; Kirschb.
Eupteryx citrinellus, J. Sahlb.
Notus aridellus, J. Sahlb.
,, *cephalotes*, Leth.; Fieb.
Dicraneura variata, Edw. pt. ii. p. 83.

This insect is exceedingly like the last described, but the vertex, pronotum and scutellum are clouded with grey; the tint of the elytron is distinctly more rufous, especially at the tips, and the wing is grey, with the nervures strongly indicated by brown. Antennæ

as long as the head and pronotum taken together. The hind tibiæ are without the fine black setal points. The abdominal apex of the female ends with a black saw-point. The post-scutellum is less developed than that seen in *D. flavipennis*, and the yellow indented patch there to be noted on the antepenultimate somite, appears to be here wanting.

Notwithstanding its synonym *N. aridellus*, it affects wet herbage. Locally it is common.

Sahlberg gives as a character of the male "valvula genetali nulla," and also "hypopygio medio profunde inciso." He states it as common near Helsingfors, from July to September.

Length of body with wings, 0·15 inch, or 3·25 millimètres.

Two species of *Dicraneura* are briefly noted in Edwards's 'Synopsis of British Cicadinæ,' which have not hitherto come under my observation. Both are rare in Britain. These are *Dicraneura aureola* of Fall. —equal to *Erythria aureola* of Sahlberg — and *D. pygmæus* of Douglas. The first insect was taken by Mr. Norman in Findhorn Marsh, Morayshire; and the latter, which appears to be the smallest British species of *Dicraneura*, measuring only 2·33 millimètres, was captured in Darenth Wood.

I have nothing to add to what has been written about these elsewhere. I merely note them here amongst what appears to be our eight indigenous species.

D. aureola is said to occur, in August and September, on the ling of our heaths, *Calluna vulgaris*.

Genus XLV.—KYBOS,* *Fieber.*

Vertex rounded and shorter than the pronotum. Ocelli visible. Elytron longer than the abdomen. Limbus wanting. The first and recond radial of the

* So-called by Fieber, perhaps from the somewhat cubic form of the vertex, which he describes as "transversalement quadrangulaire."

wing united before passing to the marginal nervure, which last is complete to the anal nervure. The third radial is unforked, but joined to the second by a short transverse nervure. The first radial, for about half its length, is confluent with the upper periphery of the wing; thus it forms only one apical cell. Genital plate of the male well developed.

KYBOS SMARAGDULA, *Fall.* Plate LXIV., figs. 3 to 3 *b*.

Cicada smaragdula, Fall.
Cicadula smaragdula, Zett.; Sahlb.
Typhlocyba smaragdula, H.-Schäff.; Flor; Kirschb.
Eupteryx viridipes, Curt.
,, *smaragdulus*, Marsh.
Kybos smaragdulus, Fieb.; Leth,; Edw. pt. ii. p. 84.

Colour somewhat variable. Vertex, pronotum and scutellum dull brick-red. Eyes black. Pronotum with pale blackish angular markings. Scutellum with one or more redder streaks. Abdomen reddish, variegated with more or less disjointed black bands, which are broadest towards the apex. Elytra green or greenish-yellow, sometimes with a fuscous stripe and darker claval suture. Legs green or pale olive. Claws or pulvelli (?) black. Wings hyaline, with the first and third radials, and the anal nervure, strongly pronounced.

The third radial, and its transverse nervure, is sometimes obsolete, or nearly so, in old cabinet specimens, due to the failure of pigment. My figure is from a rather faded example in Mr. Douglas's cabinet, and I regret that the omission, from the above cause, of the small transverse vein did not at the time of drawing occur to me.

Fieber's figure of the wing is in accordance with my description of the generic characters. The wing-neuration in *Chlorita*, the next genus, is almost identically the same as in *Kybos;* and the details of my figure 1 *d*, Plate LXV., will suit both genera.

The emerald-green tint of some specimens is in great measure lost soon after the death of the insect.

Taken on the poplar and the willow.

	Inch.	Millimètres.
Expanse	0·34	8·63
Size of body	0·14	3·55

Genus XLVI.—CHLORITA, *Fieb.*

Vertex, taken with the eyes, crescentic in shape. Elytra long and simple in venation; having three radials connected by two short angular nervures, together with a third reaching to the margin, near to the claval point. Limbus wanting. Apical cells four. The venation of the lower wing, with its marginal nervure, is like that of *Kybos*. Male genital valve wanting.

Chlorita of Fieber is equivalent to *Cicadula* of Sahlberg.

Chlorita viridula, *Fall.* Plate LXV., fig. 1 to 1 *f.*

Chlorita viridula, Fall.
Typhlocyba viridula, H.-Schäff.; Flor; Kirschb.
Eupteryx viridulus, Marsh.
,, *solani*, Curtfs, Farm Insects, pl. O, fig. 29.
Cicadula viridula, Sahlb.
Chlorita viridula, Fieb.; Edw. pt. ii. p. 85.

Small. Colour delicate, pale emerald-green. Head, pronotum and scutellum rather yellower; all of which parts are liable to undefined whitish markings. The insects just emerged from their pupal exuviæ are very bright, with fine iridescent colours thrown from both the elytra and wings. Abdomen rather broad, and sometimes bordered with white on the somatic rings.

Legs pale blue-green, and ciliated. Frons long; clypeus short, and terminated by a longish rostral sheath. The antennæ brown, with two thickened basal joints, and a compound, taper, setaceous prolongation.

The last abdominal rings of the male are attenuated, and the ultimate joint is dilated into a singular pincer-like structure, composed of the genital plates and their adjuncts. Fig. 1 *c*.

	Inch.	Millimètres.
Expanse	0·26	6·60
Body	0·09	2·27

Amongst the insects said to be injurious to the potato-plant, J. Curtis notes two small Tettigidæ, viz., *Eupteryx solani*, Curt., and *E. picta*, Curt. He gives coloured figures of both these insects, which I think are sufficient to identify them both with our own and with foreign species. *E. solani* doubtless is *Chlorita viridula*, the species now under consideration. As many as a dozen may sometimes be found on one leaf of the potato or of the mangold-wurtzel, and these may be seen leaping about until the crops are taken up in the late autumn.

On the authority of Mr. F. J. Graham the eggs of *E. solani* are white, shuttle-shaped, more pointed at one end than at the other, and striated with numerous furrows. No notice is made as to whether these ova were deposited in a groove or on the open surface of the leaf. So far as I know, the ova of the Typhlocybidæ are long, with rounded ends, and certainly not in all species striated. They may not unfrequently be seen, relatively large in number from eight to twelve, and lying within the bodies of the females just ready for exclusion in autumn.

Where the insects are plentiful, the pupa-cases may be found in multitudes, adhering to the foliage and to the clods of ground below.

Chlorita apicalis, Flor, has been recorded as British, but I have not myself met with any example of the nsect.

Chlorita flavescens, *Fab.* Plate LXV., figs. 2, 2 *a.*

Cicada flavescens, Fab.
Typhlocyba flavescens, Flor; Kirschb.
Eupteryx flavescens, Marsh.
Cicadula flavescens, Sahlb.
Chlorita flavescens, Fieb.; Edw. pt. ii. p. 85.

Colour yellowish green. Vertex rounded. Pronotum pale, with greenish stains. The scutellum sometimes shows a whitish streak. Head and abdomen ochreous-yellow; the latter is segmented and taper in form. Legs yellow; femora rather darker in tint. "The white silky hairs on the apex of the male genital plates are twice as long as the erect bristles which clothe the other portions of the same."—Edwards. Elytra long, greenish, with the membrane partially hyaline. The wings very delicate, and hardly showing the pale neuration. The hind tarsi furnished with strong spines at their articulations. Claws stout and obtuse.

Numerous throughout the autumn on various trees. Said to hybernate on firs in winter.

	Inch.	Millimètres.
Expanse	0·28	7·10
Body	0·09	2·27

Genus XLVII.—EUPTERYX, *Curtis.*

This genus, as its name indicates, is characterised by the beautiful markings of the wings, and notably also by their harmonious colouring. The chief morphological characters are as follow:—

Vertex crescent-shaped. Frons long and triangular. Elytron longer than the body. Limbus wanting. The

first, second and third radials nearly parallel, and joined at about two-thirds of their length by four short, more or less angular, transverse nervures. From the pointed centres of these last, veins are carried to the periphery, so as to make four apical areas. Similarly, the three radials of the wing are nearly parallel and connected ; the third being joined to the submarginal vein by a straight nervure.

Varied specific characters are to be found in the details of the pygofers, male and female, and in determining doubtful examples, these details should be studied.

For a preliminary grouping of the species the following table may probably render some assistance, although it be based only on colour and marking.

Synopsis of the Genus Eupteryx.

Elytron bright orange-yellow .	*E. pulchellus.*
Elytron plain, concolorous, but not white	*E. Germari.* *E. filicum.*
Elytron plain, but duskily marked at the apex . . .	*E. abrotani.* *E. tenellus.*
Elytron with a broad sinuous band	*E. vittatus.* *E. notatus.*
Elytron white, with two fine costal black lines	*E. concinna.*
Elytron white, with four roundish black spots	*E. signatipennis.*
Elytron chequered with brown annuliform spots, and bordered areas	*E. collinus.* *E. stachydearum.* *E. melissæ.*
Elytron chequered, but with areas not markedly bordered	*E. carpini.* *E. auratus.*

EUPTERYX PULCHELUS, *Fall.* Plate LXV., figs. 3 to 3*b*.

Cicada pulchella, Fall.
Cicadula pulchella, Zett.
Typhlocyba pulchella, Flor; Kirschb.; Leth.; Fieb.
Eupteryx ornatipennis, Curt., pl. 640.
,, *pulchellus*, Marsh.; Sahlb.; Edw. pt. ii. p. 94.

Female. Vertex yellow, with two perpendicular marks towards the hinder edge. Eyes black. Pronotum brown, yellow, or ochreous, with from two to four dark reddish marks. Scutellum concolorous with the pronotum. Elytron of a fine orange or orange-red colour, with a large oval whitish spot on the costal edge, the hinder part of which spot is bordered by a fine black line passing towards the apex, and bordering the four unequal pale yellow apical areas. A round black spot occurs in the first apical cell. The clavus is often of a fine red colour. Wings hyaline, with the first two radial nervures brown and strongly developed. Abdomen black above, with the apical segment pale. Legs yellow, or else nearly white.

The male is yellower in its general colour, and the apical areas of the elytron are often pale lilac and fumose at the tips.

This handsome insect is widely distributed. It is not uncommon on the oaks at Weycombe, Haslemere, and at Albery, in Hertfordshire, during August and September.

	Inch.	Millimètres.
Expanse	0·28	7·10
Body and wings	0·18	4·50

There is a pale variety with the spots and lines small and thin.

Eupteryx Germari, *Zett.* Plate LXVI., fig. 1, 1 *a.*

Cicadula Germari, Zett.
Typhlocyba Germari, H.-Schäff.; Flor; Kirschb.; Fieb.
Eupteryx Germari, Marsh.; Sahlb.; Edw. pt. ii. p. 94.

Head and body greenish grey. Pronotum darker on the disc, so also it is on the scutellum. Abdomen greyish black, somewhat ferruginous towards the post-scutellum. Last segment of the male denticulate and armed with hooks. Abdomen of the female pointed and tipped with yellow. Elytron opaque; colour warm ochreous, and fumose round the tip. Nervures, when visible, fuscous-yellow. Wings greenish grey, with strong brown nervures. Legs stout and greenish grey, or otherwise coloured olive-green.

	Inch.	Millimetres.
Expanse	3·30	8·50
Size of body and wings	0·17	4·50

Not uncommon locally. Taken in August on the Scotch or Norway pine (*Pinus sylvestris*), at Haslemere and elsewhere.

Eupteryx filicum, *Newman.* Plate LXVI., fig. 2.

Typhlocyba filicum, Newm.; Leth.; Fieb.
Eupteryx filicum, Marsh.; Edw. pt. ii. p. 93.

Whole insect concolorous, yellow or ochreous-yellow, tinged with green. Head and eyes somewhat pinkish. Elytral nervures faint and greenish. An obscure semilunar whitish spot is sometimes seen on the costa. Wings hyaline and iridescent. Legs all yellow. Abdomen black, with yellowish hind margins

to the segments. Genital valves of the female bright yellow.

This insect, up to quite recently, has been considered rare. Mr. Marshall some years ago took it at Milford, and Mr. Douglas also in the neighbourhood of London. Probably, if search be made, it is not, after all, so very uncommon.

In the month of October, 1889, I saw several exotic pot-ferns growing in the hothouse of Dr. Tyacke, in Chichester, the fronds of which were speckled with white dots, obviously the punctures of an insect. The gardener captured several small Typhlocybidæ from these plants, and he assured me that they made the ferns yellow and sickly. As many as fifty specimens might sometimes be found infesting a single plant.

An examination of the wing-veining proved the genus to be *Eupteryx;* and I have no reasonable doubt that, notwithstanding the presence of two pale fuscous strigæ on each elytron, the insects were *E. filicum*, as above described. My figure is from Mr. Douglas's cabinet, and probably is a little faded. I have several specimens in my cabinet.

Length with wing, 0·14 inch, or 3·50 millimètres.

Eupteryx signatipennis, *Boh.* Plate LXVI., fig. 3.

Typhlocyba signatipennis, Boh.
Eupteryx signatipennis, Marsh.; Sahlb.; Fieb.; Edw. pt. ii. p. 92.

Vertex pale, with two minute spots near the fore-edge. Pronotum yellowish or greenish white; sometimes grey, with—or more commonly without—two black lateral spots: when these spots occur, two basal black spots mostly appear also on the scutellum. Abdomen taper, dark brown, with a paler band above the pygofer. Elytron yellowish white, or else very pale green. The

apex fuscous. Two rather large black spots occur; one a little below the costa and half-way from the apex, the other on the suture of the clavus. Wings delicate, hyaline, iridescent, and slightly fumose at the tips. Veining almost obsolete, or else very difficult to see. Elytra are sometimes seen, but not often, entirely without spots.

Local. Apparently it feeds on the meadow-sweet (*Spiræa ulmaria*).

	Inch.	Millimètres.
Expanse	0·25	6·50
Size with wings	0·14	3·50

Several examples in Mr. Douglas's cabinet are more fuscous than that of the example I figure.

EUPTERYX TENELLUS, *Fall.* Plate LXVI., figs. 4 to 4 *a*.

Cicada tenella, Fall.
Typhlcoyba tenella, H.-Schäff.; Flor; Kirschb.; Fieb.,
Eupteryx tenellus, Sahlb.; Doug.; Edw. pt. ii. p. 92.

Small. Head pale ochreous-yellow, with two large round black spots on the vertex. A semilunar spot at the base. Frons pale, with two smoky and converging stains. Pronotum fuscous, with a broad transverse smoky mark, and a broad black line below. Abdomen black. Margins of the segments yellow, and similarly so coloured underneath. Legs yellow, with fuscous tarsi. Elytron greenish yellow, with one or more broad longitudinal pale stripes. Wings iridescent.

Length with wings, 0·12 inch, or 3·00 millimètres.

Marked "scarce" by Edwards. Taken on the common yarrow (*Achillea millefolii*) at Eartham, near Norwich; also at Birdbrook, Essex. Said also to feed on the common nettle (*Urtica dioica*). August.

EUPTERYX VITTATUS, *Linn.* Plate LXVI., fig, 5.

Cicada vittata, Linn.
Cicadula vittata, Zett.
Typhlocyba vittata, H.-Schäff.; Burm.; Flor; Kirschb.; Leth.; Fieb.
T. 4-signata, Hardy.
Eupteryx vittatus, Marsh.; Sahlb.; Edw. pt. ii. p. 87.

Vertex round. Head yellow or light reddish brown, with two notched dark brown upright marks. Pronotum and scutellum dark brown. Elytron ochreous-yellow, with a very broad brown sinuous band from apex to base; the edges of the same darker. Wings with the membranes pale brownish black; with the first, second, and third radials stout and brown. Abdomen deep black, with pale yellow margins to the segments. The abdomen of the female has a triangular yellow spot or caudal cellule on the penultimate somite. Legs and sternum pale yellow. Sawcase of the female protruberent. The wings are sometimes pinkish at their base.

Common in damp places throughout July and August. Hellesdon; Lewisham.

	Inch.	Millimètres.
Expanse	0·25	6·50
Size with wings	0·12	3·00

Mr. J. W. Douglas, in July, 1882, found this species to be not uncommon on some ground-ivy (*Nepetes glecoma*) growing in his garden at Lewisham. He found also the pupa-skins on the leaves. There is therefore good room to believe that the ground-ivy, which is a Labiate, is at least one of the natural food-plants of this insect.

Eupteryx collinus, *Flor.* Plate LXVI., fig. 6.

Typhlocyba collina, Flor; Kirschb.; Leth.; Fieb.; Edw. pt. ii. p. 90.

Small. Vertex with three black spots on a pale ground; that nearest the base is U-shaped. Edwards says the mark is always V-shaped on the *crown.* Pronotum pale, nearly white, with two or four brown clavate marks rising from a transverse basal line. The middle of these two converge so as to form a V-like mark. Elytron pale ochreous and whitish, with several open, annular, square or oblong spots; each of which is bordered with brown. Wings hyaline. Legs pale yellow. Hind tibiæ "narrowly black at their apices." Outer edge of the hind tibiæ of the female without fuscous spines.

Locally abundant on labiates, such as the black horehound (*Ballota nigra*). Norwich and other places.

Size with wings, 0·12 inch, or 3·00 millimètres.

Eupteryx concinna, *Germ.* Plate LXVII., fig. 1.

Tettigonia concinna, Germ.
Typhlocyba concinna, H.-Schäff.; Leth.; Fieb.
Eupteryx concinna, Ferrari; Edw. pt. ii. p. 95.

Colour creamy white. Eyes black. Abdomen robust, with a broad black band covering the middlemost segments; this band may be either straight or angular in form, Legs pale, almost white, with longish setæ. Elytron white, more or less hyaline, with faintly-marked yellow nervures. A short, fine, black striga crosses from the costa to the post-radial vein, near to the middle of the border, and also a smaller striga similarly at about two-thirds. Occasionally a small T-like mark is seen near to the claval point. Wing

rounded at the apex, with faint buff neuration. The abdominal apex is furnished with fine hairs. The black ovipositorial saw of the female is often freely exserted. The under side is all yellowish white.

Mr. Edwards says, "Exceedingly like a pale whitish variety of *E. pulchella*." Individuals show faint dun-coloured marks on the pronotum. The examples which have come under my notice do not approach the marked colouring of that species. The male genitalia will be found to differ considerably in structure from *E. pulchella*.

Taken on oaks at Weycombe, Haslemere; also at Tyntesfield, Somersetshire; and Felthorpe, Norfolk. August and September.

	Inch.	Millimètres.
Expanse	0·280	7·10
Body alone	0·12	3·04

This is a delicate and elegantly-shaped insect, whence its specific name.

Eupteryx abrotani, *Douglas*. Plate LXVII., fig. 2.

Eupteryx abrotani, Doug., Ent. Mo. Mag. xi. p. 118; also *ibid*., xxi. p. 89; Fieb.; Edw. pt. ii. p. 93.

Head, prothorax and scutellum pale green, which colour, after death, commonly fades to a dirty buff-colour. These parts are almost spotless, although sometimes fuscous stains may be noted upon them. Elytron pale whitish, hyaline, with a tendency to show a white round spot near to the middle of the costa. The apical portion fuscous, with the areas faintly bordered with smoky brown. Wing rounded, with the three radial and the anal nervures markedly brown. Abdomen black or deep brown, with a palish triangular mark above the pygofer. Legs pale ochreous, with a faint longitudinal line on each of the hind tibiæ.

This species was first taken in Britain by Mr. J. W. Douglas, who, in the August of 1874, found it feeding on *Artemisia abrotanum.* Several of these plants were growing in a cottager's garden on the moors near West Kilbride, in Ayrshire, Scotland. They were then plentiful, as many as twenty individuals being secured by sweeping with the net.

Subsequently Mr. Douglas took a single example of the same insect in his garden at Lewisham; from which we may infer that the food-plant and other examples of the insect were not far distant.

It occurs in Fieber's Catalogue of Typhlocybini, and seems to affect different kinds of wormwood, like *Artemisia maritima* and *A. abrotanum.*

	Inch.	Millimètres.
Expanse	0·22	5·82
Body only	0·15	3·81

EUPTERYX URTICÆ, *Fab.* Plate LXVII., fig. 3, and LXVIII., figs. 4 to 4*a*.

Cicada urticæ, Fab.
Cicadula urticæ, Zett.
Typhlocyba urticæ, H.-Schäff.; Flor; Kirschb.; Leth.; Fieb.,
Eupteryx tarsalis, Curt.
,, *urticæ*, Marsh.; Sahlb.; Ferrari; Edw. pt. ii. p. 88.

Small. General colour pale yellowish, variegated with black. Head round. Eyes brown. Two large black spots on the occiput. Frons yellow, with the sides black. Pronotum yellow or pale, with a large black spot on the fore margin continued down the sides, and three darker spots on the disc, which are often confluent. Scutellum with two basal marks, and with a

fine line below them. Abdomen stout, with the somites near the scutellum dusky brown; other somites black, except the last in the male, which is ochreous. All black underneath, except the frons and the legs, all of which are yellow. The elytron shows fuscous margins to the areas, with the membrane almost white. A greener tinge near the middle of the costa is sometimes seen. Various confluent and likewise several black or else dark brown squarish spots cover the disc of the elytron; the apical areas being partly fumose at their borders. Two or more spots on the clavus. The hind tibiæ are black or dark brown; the tarsi long and yellow. Wings finely iridescent; sometimes they are brownish in tint.

Very common on *Urtica dioica* at Malvern, and also in some seasons at Haslemere, from July to October.

	Inch.	Millimetres.
Expanse	0·25	6·35
Body only	0·09	2·27

Seems to be plentiful throughout Finland and all Scandinavia.

EUPTERYX NOTATUS, *Curt.* Plate LXVII., figs. 4 to 4*a*.

Eupteryx Wallengreni, Sahlb.
,, *diminuata*, Ferrari.
,, *diminuta*, Kirschb.; Leth.
,, *notata*, Curt.; Edw. pt. ii. p. 88.

This insect in many respects resembles *Eupteryx vittatus*, but it is much smaller. The vertex is also more acute, and the fillet across the elytron more wavy in outline. Some examples are of a brighter yellow.

Vertex unspotted. Pronotum and scutellum as in *E. vittata*. All the under side is yellow. Genital valve of the male very short. The band or fillet on the

elytron is more pronounced in some examples than in others. When the wings are closed a yellow spot becomes conspicuous at the suture. A similar spot also may be seen in *E. vittatus*.

Not uncommon on the garden grass-plots at Great Malvern, and on low plants at Haslemere.

Sahlberg notes three varieties of this species.

	Inch.	Millimètres.
Expanse	0·16	4·00
Length with wings	0·10	2·75

Eupteryx carpini, *Fourc.* Plate LXVII., figs. 5, 5 *a*.

Cicada carpini, Fourc.
,, *picta*, Fab.
Typhlocyba picta, H.-Schäff.; Flor; Kirschb.
,, *aureota*, Boh.
,, *carpini*, Leth.; Fieb.
Eupteryx pictus, Marsh.; Curt.
,, *carpini*, Ferrari; Edw. pt. ii. p. 91.

Vertex rounded, white, with two large black spots. Eyes reddish. Pronotum white, with two comma-shaped black marks nearly meeting at the fore margin. Scutellum with two black basal marks. Elytron pale buff, with three irregular and blurred marks on the costa, and two black spots on the inferior margin of the elytron. The disc of the elytron has several other more or less obscure marks, and a fuscous stripe down the middle. The irregular curved stripes are better seen when the elytra are closed. Abdomen broad, and stained on the upper parts with ferruginous-brown. Rest of the abdomen black with yellowish edgings, except the apex and a transverse dorsal stripe, which are brownish.

Notwithstanding its specific name, which refers to the hornbeam, this insect is recorded to feed on "various low plants, and especially on labiates."

My figures are from specimens in Mr. Douglas's cabinet, two out of five of which are noted as feeding on the mullein (*Verbascum*). They are labelled *Eupteryx picta*, Fab., and have also the synonymn *E. punctata*, Goetz.

Although the hornbeam (*Carpinus betulus*) is sufficiently common at Haslemere, I have not taken the above insect under its shelter.

	Inch.	Millimetres.
Expanse	0·27	6·25
Body only	0·11	2·75

Mr. Whitehead says that *Typhlocyba picta*, or the hop-jumper, much weakens the hop-plants by boring holes in the leaves and bines, and sucking their juices.

I presume this insect is equivalent to one of the above-given synonyms of *E. carpini*. J. Curtis says it also affects the burdock and the nettle. When injury is thus done to the hop-plant, the use of boards smeared with tar and held towards the vines are recommended, whilst the plants are shaken. "The tar will entangle great numbers"; but on a large scale it is doubtful if much benefit can be had by such a procedure. A thunder shower would be far more efficacious, but science and meteorology cannot yet command such service from the clouds.

Curtis first observed this insect in 1847. He noticed them upon his potatoes in the middle of June, and by August he found them greatly increased in numbers, although the foliage of the plants was still green and healthy. When disturbed they flew at about one foot from the ground, but they soon returned to the under sides of the leaves for shelter.

A good figure, and sufficient for identification, although the colouring is too green, is on Plate O, figs. 32, p. 473, of J. Curtis's 'Farm Insects.' 1860.

Eupteryx stachydearum, *Hardy*. Plate LXVIII., fig. 1.

Typhlocyba stachydearum, Hardy.
,, *Curtisii*, Flor; Leth.; Fieb.
Eupteryx hortensis, Curt.
,, *stachydearum*, Marsh.; Edw. pt. ii. p. 89.

Vertex whitish, with an x-like mark on the crown. Pronotum fuscous-grey, furnished with two inverted n-like marks and two small lateral spots. Scutellum with two basal triangular marks and the representation of a mask. Abdomen long and taper; rings edged with yellowish brown. The last three somites grey. Legs yellow, with black points to the tarsi. First joint, like many other species of this genus, much the longest. Elytron yellowish. with a whitish spot near the apex, bordered with brownish black, and a larger white spot near the middle of the costa. The rest of the disc is divided into oblong annular spots, and irregular angular spaces, all of which are bordered inwardly with fuscous. Sternum and abdomen black; hind margins of the latter yellow.

Often may be found on the common wood-sage (*Teucrium scorodonia*), and on other Labiates. This insect is not very unlike a small example of *E. collinum*, but the marks on the head and pronotum differ much, and the general tints are darker.

	Inch.	Millimètres.
Expanse	0·23	5·84
Body only	0·12	3·12

The marks on the vertex of the female sometimes become obsolete in the male.

These insects are very lively and difficult to secure.

Eupteryx auratus, *Linn.* Plate LXVIII., figs. 2 to 2*a*.

Cicada aurata, Linn.; Fab.; Fall.
Typhlocyba aurata, H.-Schäff.; Flor; Kirschb.; Leth.; Fieb.
T. picta, Burm. *T. fulva*, H.-Schäff.
Eupteryx auratus, Marsh.; Sahlb.; Ferrari; Edw. pt. ii. p. 91.

Vertex yellow, somewhat pointed. Occiput with two black squarish spots. Pronotum one-third longer than the head, greenish yellow, with two large lateral black and rounded spots; these together are sometimes reniform. Scutellum black, with a green or yellow spatuliform mark, having a fine striga. Abdomen taper, long, dark brown, with paler somatic edgings. The pygofer of the female is pointed; that of the male complex, with two angular and curved cornua, two styles, accompanied by a lower sheath-like appendage (*theca*). The penultimate ring has the oblong caudal cellule noted in other species, the significance of which is as yet obscure. The last abdominal segment finely hirsute (see fig. 5, Plate LXII.). Elytron yellow-green, but grey towards the apex. The costal edge with a large black round spot, succeeded, at about half its total length, by another spot, or rather sinuous band, broad at its upper part, and thinly ending at the apical areas. Half-way between the last band and the pronotum, another narrow curved black band also curves towards the elytral apex; between these two bands a darker green patch is seen. Below, and nearly parallel to the second black band, a third appears running along the lower marginal edge. A black spot may be seen on each clavus. Some parts of the disc of the elytron are brighter than others, and this colouring gives the insect somewhat of a golden appearance.

The wings are long, delicate, and iridescent. The legs golden yellow, with yellow ciliations. Frons all yellow, except two rich brown spaces from between the eyes pointing towards the yellow clypeus and rostral sheath. A black spot sometimes occurs on the third and fourth apical areas of the elytron. The sinuous bands are different in character from the more isolated spots of the preceding species; but no two insects are perhaps strictly alike in their markings.

Taken sparingly on the garden mint at Norwich, in company with *E. carpini*, *E. stachydearum*, and *E. melissæ*.

I found this insect very common, and nestling on the potato-plants in gardens at Great Malvern. It has been thought hitherto rather rare; but Mr. Marshall thought it "sufficiently common throughout this country," and probably it has been overlooked by entomologists.

	Inch.	Millimètres.
Expanse	0·29	7·35
Size of body	0·13	3·30

For details of the male pygofer compare Plate LXII., figs. 3 and 5.

EUPTERYX MELISSÆ, *Curt.* Plate LXVIII., figs. 3 to 3 *d.*; also Plate LXII., figs. 3 and 4.

Eupteryx melissæ, Curt.; Marsh.; Ferrari; Edw. pt. ii. p. 90.
Typhlocyba melissæ, Leth.; Fieb.

Vertex rather convex. Colour greenish white. Crown with three marginal black spots, and a round basal spot on the base. Eyes grey. Antennæ brown and long. Pronotum semilunar in shape, with two narrow dashes on the upper edge, and two others on each side thereof towards the straight hind border. Scutellum with two

PLATE LIX.

LIMOTITTIX STRIOLA. (Page 87.)

Fig. 1.—The male.

Fig. 1 *a*.—The larger female, with its broader head and straight band on the crown.

Fig. 1 *b*.—The head more magnified, and showing the characteristic streak disjointed.

Fig. 1 *c*.—The streak, as seen double in some males.

LIMOTETTIX INTERMEDIA. (Page 87.)

Fig. 2.—The imago, with four punctures on the vertex.

Fig. 2 *a*.—The face, frons, and legs. The fore legs have each a stiff bristle at the end of the femur.

LIMOTETTIX VARIATA. (Page 88.)

Fig. 3.—The male, showing V-shaped bars across the closed elytra.

Fig. 3 *a*.—The female, drawn of relative size.

Fig. 3 *b*.—The face, showing four spots on the frons.

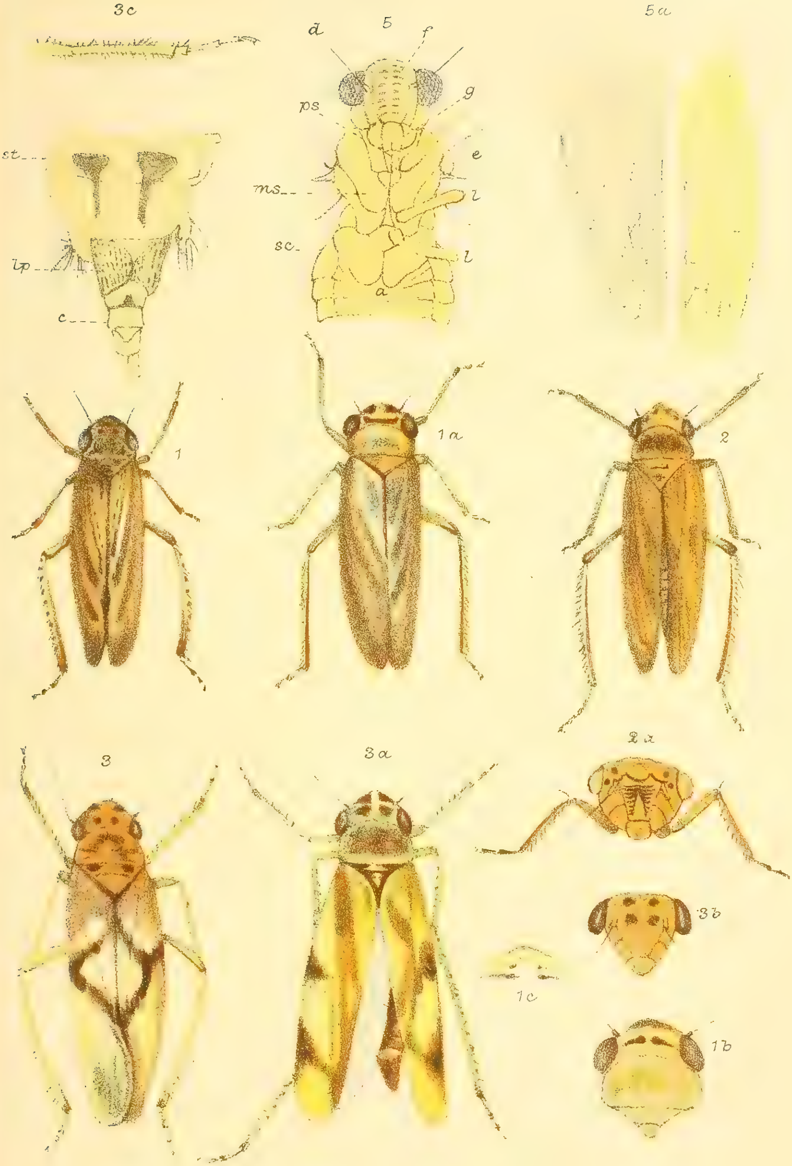
Fig. 3 *c*.—The hind tibia, with its tarsus of three joints, the first of which is the longest.

Fig. 4.—The last abdominal joints of the male of *Limotettix crocea*. The parts, before dissection, have been digested in potash solution, and thus they are made transparent. At *s*, *t*, the internal genital styles are seen with their broad bases *in situ*. Two wart-like tufted prominences occur close to the spotted lateral plates, and the telescope-like cauda, protruded somewhat by pressure, is shown at *c*.

Fig. 5.—Part of the under side of the same insect, showing the different plates which compose the thorax or chest. *f.* The frons. *cl.* Clypeus. *g.* The genæ. *ps.* Prosternum. *ms.* Metasternum. *sc.* Scales or plates, in form and position somewhat recalling those which cover the stridulating organs of *Cicadetta*. *a.* Abdomen. *e.* Base of an elytron. *w.* The base of a wing. *l, l.* Femora of the middle and hind legs.

Fig. 6.—Elytron and wing of *L. sulphurella*. A short transverse nervure joins the first and second radial of the elytron, and is very similar to that shown in *L. crocea* on Plate LX. This short vein has been accidentally ommitted in fig. 6.

PLATE LIX



G.B.B. del.et lith.

West, Newman chromo.

PLATE LX.

Limotettix nigricornis. (Page 89.)

Fig. 1.—Male insect, showing four spots on the closed elytra, and five bars on the pronotum.

Fig. 1 *a*.—Female of the same, without these punctures.

Limotettix antennatas. (Page 90.)

Fig. 2.—Imago, with the long antennæ and the crescentic stain on the pronotum.

Limotettix metrius. (Page 91.)

Fig. 3.—Imago, with the wing spread open, below the elytron.

Fig. 3 *a*.—Face, frons, and clypeus of the same.

Limotettix crocea. (Page 91.)

Fig. 4.—Male, with the wings outspread.

Fig. 4 *a*.—Another example, with the elytra closed, and showing a ridge on the vertex.

Fig. 4 *b*.—Non-limbated elytron, and wing of the same.

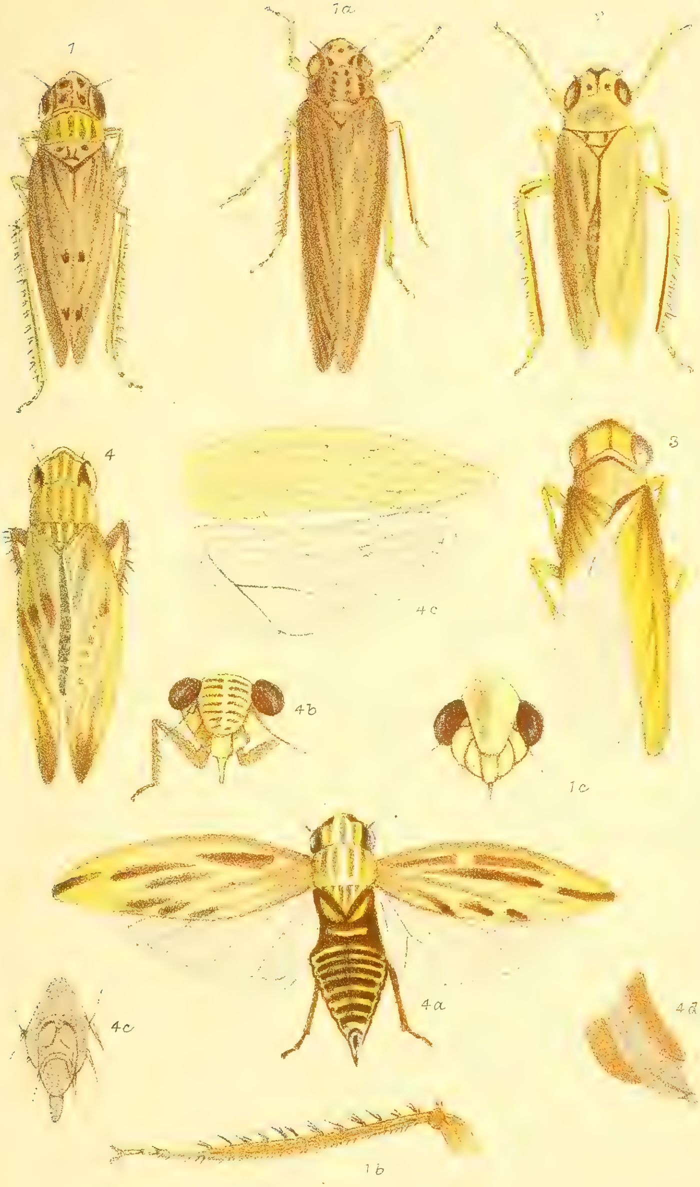
Fig. 4 *c*.—Face, frons, and fore legs of the same.

Fig. 4 *d*.—Upper side of the pygofer, showing the œdeagus and the caudal process of fig. 4.

Fig. 4 *e*.—Under side of the female, partly showing the genital plates and saw-valves.

Fig. 4 *f*.—Hind tibia, and the three jointed tarsus.

N.B.—Fig. 4, Plate LIX, shows the under side of the pygofer, more magnified; and fig. 5 shows the details of the sternum of the same insect.



G.B.B. del. et lith.

West, Newman chromo.

PLATE LXI.

Gnathodus punctatus. (Page 93.)

Fig. 1.—Insect with its closed wings, and showing its short or narrow vertex.

Fig. 1 *a*.—Elytron and wing of the same. The former has a narrow limbus.

Fig. 1 *b*.—The four last somites or segments of the male abdomen.

Fig. 1 *c*.—The face and frons. The ocelli are distinctly marked, and the genæ are bounded by black, separating borders. The antennæ spring from oblong, swollen processes, placed near to the eyes.

Alebra albostriella. (Page 102.)

Fig. 2.—Male, with its expanded wings, and the narrow elytral limbal edge. The grey caudal chamber on the penultimate segment may be noted.

Fig. 2 *a*.—A marked variety of the same species. Externally, on account of its striped elytra, it somewhat resembles one of the species of the allied genus *Zygina;* but the character of the venation at once shows where the insect should be rightly placed.

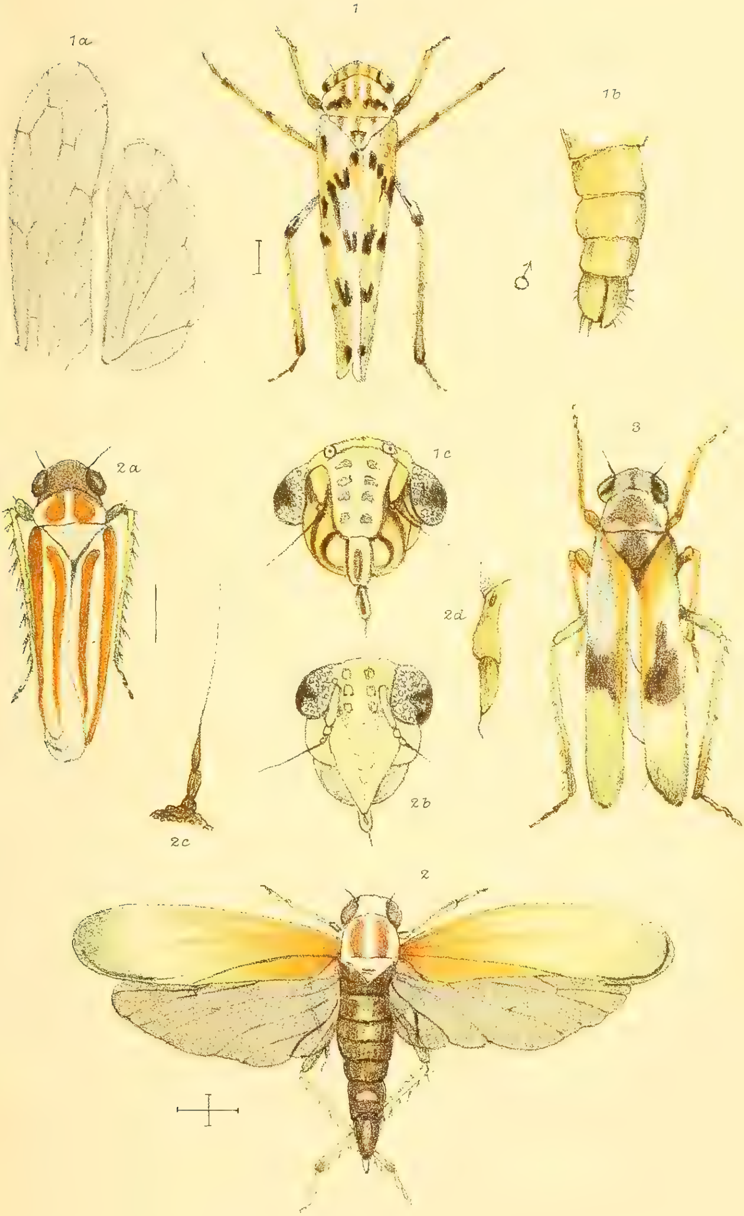
Fig. 2 *b*.—Front view of the face, showing the long frons and the small clypeus.

Fig. 2 *c*.—Antenna, with part of the process from which it takes its origin.

Fig. 2 *d*.—Rostrum much magnified.

Alebra Wahlbergi. (Page 103).

Fig. 3.—Specimen, with closed elytra, drawn from an insect in Mr. Douglas' collection. A similar insect, with spread wings, may be seen on Plate LXII, fig. 1.



G.B.B. del. et lith.

West, Newman chromo

PLATE LXII.

ALEBRA WAHLBERGI. (Page 103.)

Fig. 1.—Imago, drawn in perspective, with its outspread wings.

Fig. 1 *a*.—Abdomen, showing the caudal chamber at *v*, and the genital plates.

Fig. 1 *b*.—Abdominal apex of the same, seen in profile.

Fig. 1 *c*.—Part of the clavus, showing red pigment spots.

DICRANURA CITRINELLA. (Page 104.)

Fig. 2.—Imago, with its plain, unspotted elytra and wings. These organs are commonly too delicate to show the usual neuration.

Fig. 2 *a*.—The pygofer, with its details. viewed from above. The significance of these parts is not well understood. The caudal-cell or caudal-chamber, with the style, is seen at *v;* below which, at *d*, two black spines are developed. The last segment ends with a broad plate, which is deeply notched; and at the summit of this notch a cordate oval process appears superposed.

Fig. 2 *b*.—Wing, which, under a particular illumination, is seen to be finely punctate, and faintly marked with nervures.

Fig. 3.—Profile view of the abdominal apex of the male of *Eupteryx melissæ*. *c*. Caudal process. *s*. Styles, below which, at *t*, may be seen a theca or spoon-shaped sheath.

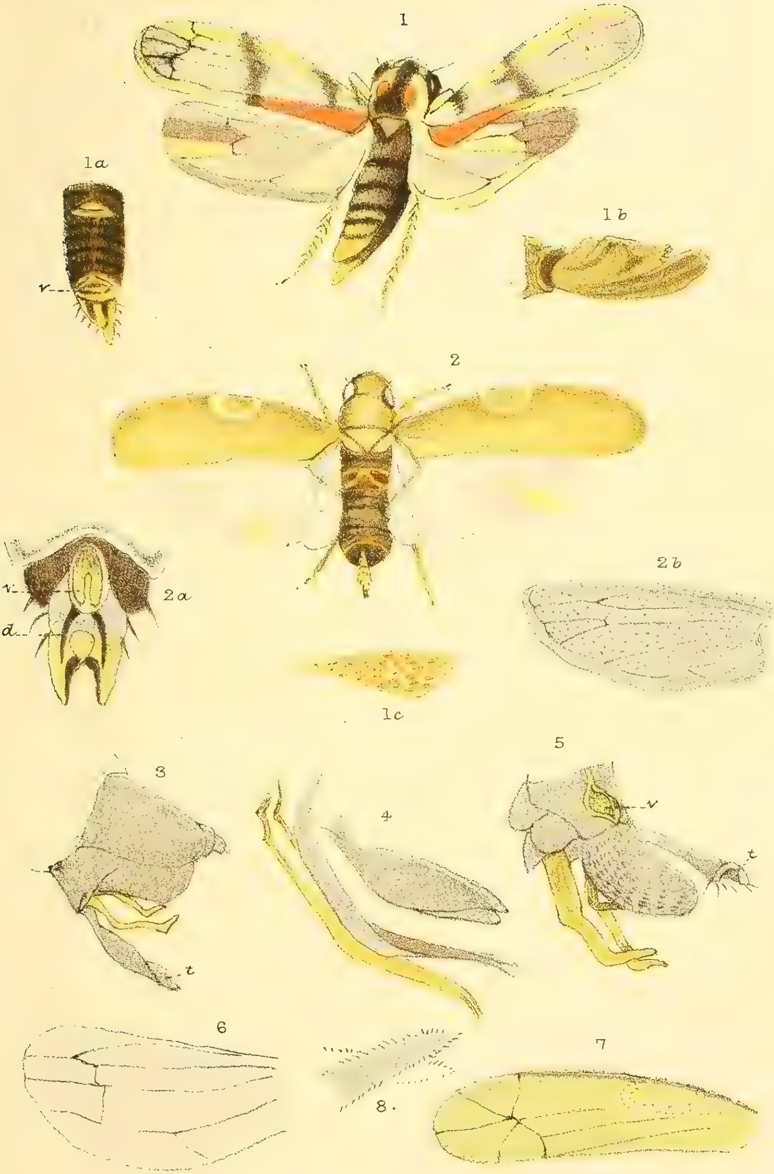
Fig. 4.—Details of ovipositor, as shown by a dissection made by Dr. Capron. *o*. Portions of the ovipositor. In the figure below, the points of these blades are under greater amplification, represented with their serratures.

A figure of the complete insect may be seen on Plate LXVIII.

Fig. 5.—Details of the last abdominal ring of the male of *E. auritus*. *v*. Caudal cellule. *s*. Styles. *t*. Theca, which probably is here displaced. It should appear below, as drawn in *E. melissæ*.

Figs. 6 & 7.—The elytron and wing of *Typhlocyba geometrica*.

PLATE LX.



G.B.B. del. et lith.

West Newman chromo.

PLATE LXIII.

DICRANURA MOLLICULA. (Page 105.)

Fig. 1.—Imago, with expanded and irridescent wings.

Fig. 1 *a*.—Another specimen, with folded wings.

Fig. 1 *b*.—Elytron, without any limbus.

Fig. 1 *c*.—Wing of the same insect, showing the union of the first and second radial nervures, before they end in the marginal nerve.

Fig. 1 *d*.—Pygofer of the male, showing the caudal chamber and lateral processes.

Fig. 1 *e*.—Under side view of the female, with the emarginate ventral plate and valves.

DICRANURA SIMILIS. (Page 106).

Fig. 2.—Imago, showing the external chambers of the abdomen.

Fig. 2 *a*.—Another example, with wings closed.

Fig. 2 *b*.—General details of the male insect. Œdeagus. *c*. Cauda, with setæ.

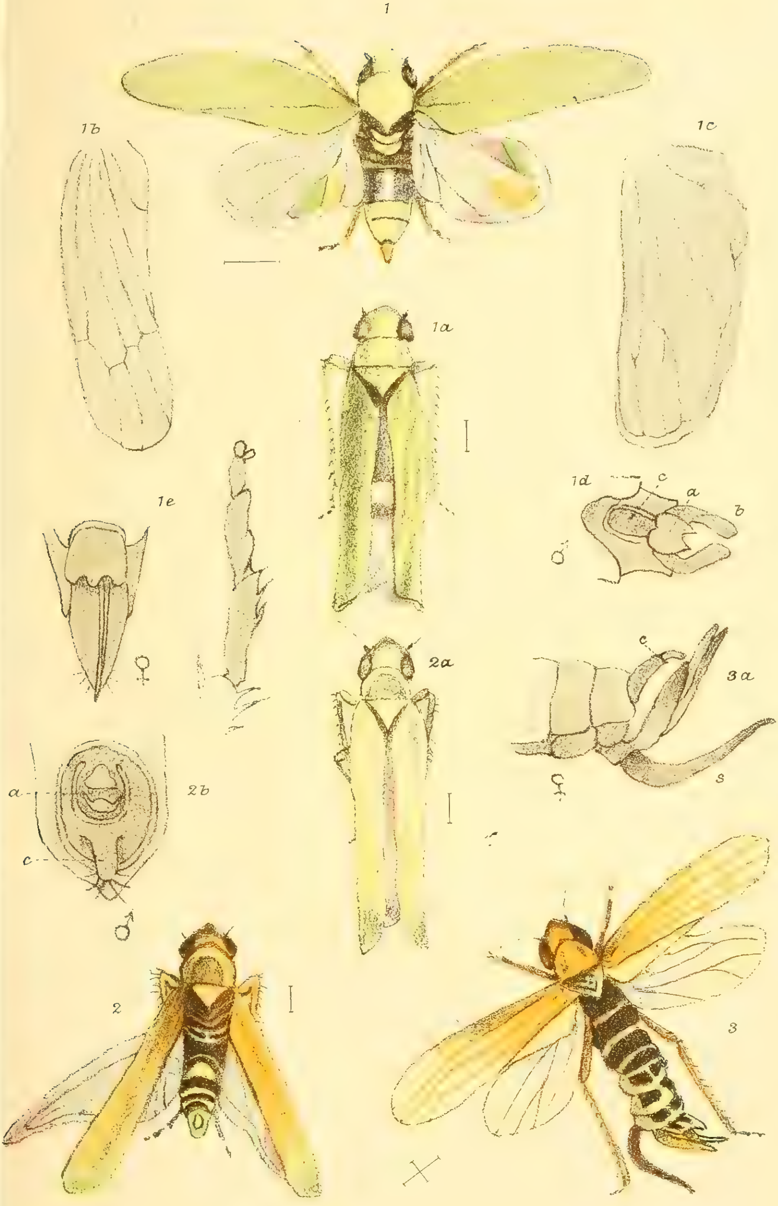
DICRANURA ARMATA. (Page 107.)

Fig. 3.—Examples of the female, showing the large development of the saw-apparatus, with its sheaths.

Fig. 3 *a*.—The three last abdominal rings of the female, more magnified. The caudal process is seen in profile above, at *c*.

Fig. 4.—Hind tarsus of *Dicranura flavipennis*.

PLATE LXIII



G.B.B. del. et lith.

West, Newman chromo.

PLATE LXIV.

Dicranura flavipennis. (Page 108.)

Fig. 1.—The imago. The elytra and wings are too dense in the one, and too delicate in the other, to show all the usual nervures.

Fig. 1 *a*.—Extreme apex of the abdomen of the male, as seen from above.

Fig. 1 *b*.—Apex of the abdomen of the female, as seen partly in profile. The saw-valves may be noted below.

Fig. 1 *c*.—Part of the male abdomen, in which the antipenultimate segments are constricted. On the last ring there is a shallow pit, which appears to have a membrane stretched over its floor. I am unable to suggest any economic use for this structure; and, elsewhere, I have simply called it the caudal cellule. The cauda, however, which probably is the termination of the alimentary canal, is developed more towards the apex. See fig. 1 *a*.

The above abdominal constriction appears to be confined to the male sex. Other species of *Dicranura* show, also, some tendency to this variation of form.

Fig. 1*d*.—Part of the pronotum and scutellum of the same insect. The details of the post-scutellum are drawn, together with the insertions, of the elytra and wings.

Dicranura variata. (Page 108).

Fig. 2.—Example, with wings expanded; some of the nervures are obsolete, both in the elytron and wing.

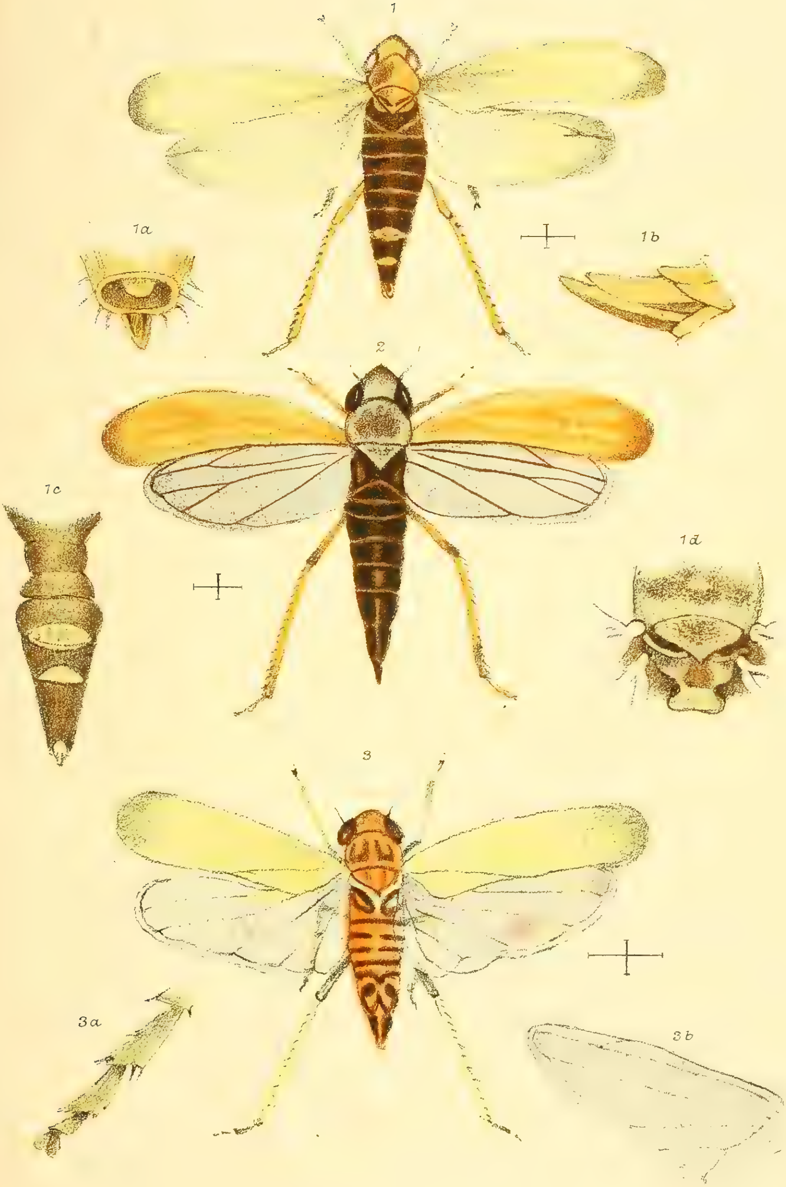
KYBOS SMARAGDULA. (Page 110.)

Fig. 3.—Imago, with its concolorous elytra. As before remarked, unless the wings be separated from the insect, and placed under a lens, without the use of Canada balsam, the true venation cannot be seen. In the *Typhocybidæ*, some nervures are often more prominently and stoutly marked than the others.

Fig. 3 *a*.—Hind tarsal joints, which are shortly spurred. The last joint shows two pulvilli, instead of two claws.

Fig. 3 *b*.—Wing, with its fore marginal nervure complete to the apex.

PLATE LXIV



G.B.B. del. et lith.

West, Newman chromo.

PLATE LXV.

Chlorita viridula. (Page 111.)

Fig. 1.—Insect, as seen in profile seated upon part of a potato-stalk.

Fig. 1 *a*.—Another example, with closed elytra.

Fig. 1 *b*.—Face, frons, and legs of the same insect. Correctly, all the drawings of the frons, &c., in the foregoing plates are to be considered as seen from the ventral aspect. The faces of these insects are always prone, that is to say, they are turned downwards, not forwards, as in most other insects.

Fig. 1 *c*.—The last abdominal joints of the male, showing the peculiar crab-like termination of the genital plates; and the constricted body-rings.

Fig. 1 *d*.—Elytron and wing. The former is without a limbus or appendix.

Fig. 1 *e*.—Antenna, much magnified.

Fig. 1 *f*.—Profile view of the head and antennæ.

Chlorita flavescens. (Page 113.)

Fig. 2.—Imago, with its yellowish body.

Fig. 2 *a*.—Three tarsal joints of the hind legs, the first and third of which are spurred. The lower part of the tarsus, also, is spurred.

Eupteryx pulchellus. (Page 115.)

Fig. 3.—Insect, with the elytra and wings partly expanded.

Fig. 3 *a*.—Male insect. Elytra with pale greyish apices.

Fig. 3 *b*.—Elytron, from another specimen, with varied markings.

G.B.B. del.et lith.

West, Newman chromo.

PLATE LXVI.

EUPTERYX GERMARI. (Page 116.)

Fig. 1.—Imago; the elytra are without markings, and with nervures only faintly indicated. Wings with the first three radial and the anal nervures strongly developed.

Fig. 1 *a*.—Last abdominal rings of the same insect.

EUPTERYX FELICUM. (Page 116.)

Fig. 2.—Insect, with closed wings. The white annular spots on the elytra are more visible in some specimens than in others.

EUPTERYX SIGNATIPENNIS. (Page 117.)

Fig. 3.—Example showing the characteristic spots on the elytra. The wing-nervures are faint.

EUPTERYX TENELLUS. (Page 118.)

Fig. 4.—Insect, which shows the smoky cloudings on the apical cells of the elytra.

Fig. 4 *a*.—Frons, with the rounded black vertical spots.

EUPTERYX VITTATUS. (Page 119.)

Fig. 5.—Example showing the characteristic broad band on the elytron. Some of the usual wing-nervures are invisible.

EUPTERYX COLLINUS. (Page 120).

Fig. 6.—The V-like marks may be noted on the head, and the plumose spot on the pronotum.

Fig. 7.—*Eupteryx parvulus* of Marshall. See *Zygina parvula* of Boheman, described after the genus *Typhlocyba*. It correctly belongs to *Zygina*.

G.B.B. del. et lith.

West, Newman chromo.

PLATE LXVII.

EUPTERYX CONCINNA. (Page 120).

Fig. 1.—Imago. Perhaps this insect is the palest in colour of all the species of this genus.

EUPTERYX ABROTANI. (Page 121.)

Fig. 2.—Imago. The elytra are often less strongly variegated at the tips than is shown in this specimen.

EUPTERYX URTICÆ. (Page 122.)

Fig. 3.—The black lines on the elytra have a tendency to become confluent and flowing in form.

EUPTERYX NOTATUS. (Page 123).

Fig. 4. — The elytral bands have somewhat the character of *E. vittata*, but the last insect is larger.

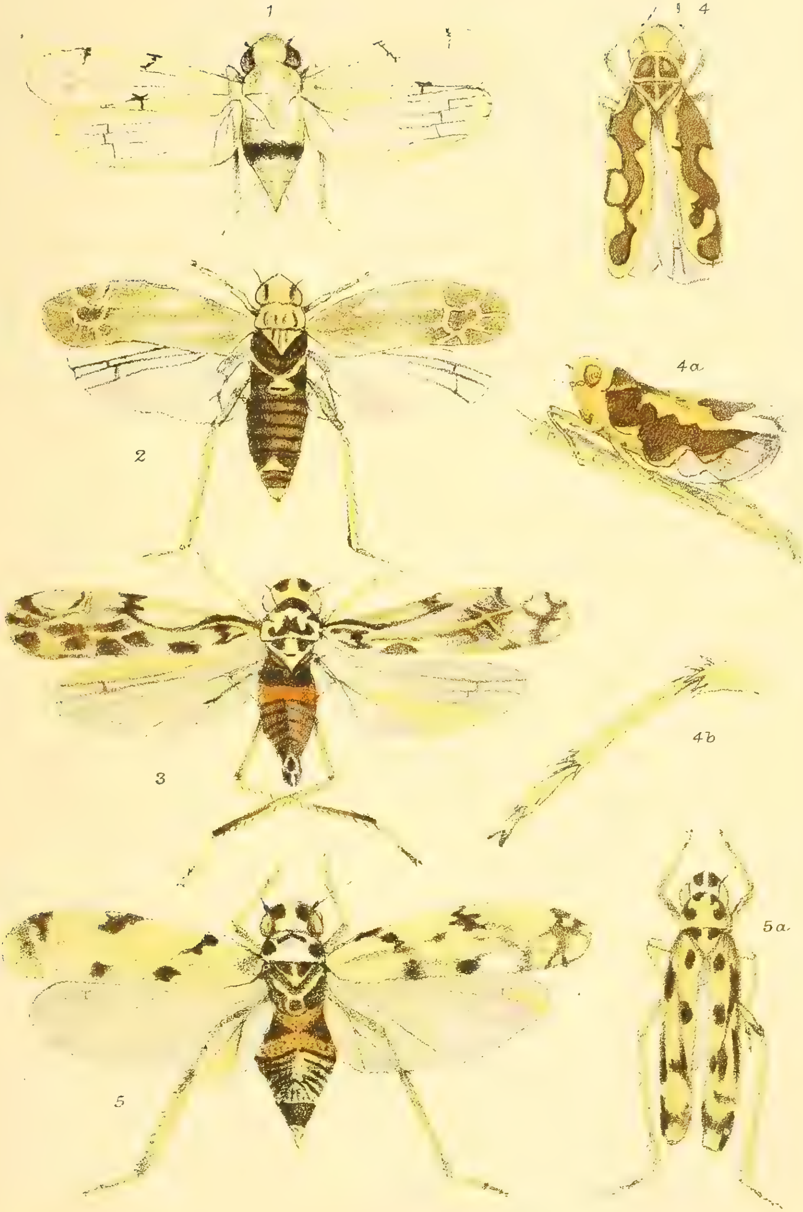
Fig. 4 *a*.—The insect drawn in profile. The tips of the elytra are rather membranous and transparent.

Fig. 4 *b*.—Part of the hind leg and tarsus.

EUPTERYX CARPINI. (Page 124.)

Fig. 5.—This drawing is from a specimen in Mr. Douglas's collection, labelled *E. atropunctata*, Goetz, and with the synonymn *C. pictus* of Fab. The isolated character of the spots contrasts very generally with those of the formerly described species.

Fig. 5 *a*.—A drawing, also from an insect in the Douglas-collection, with cloudy elytra. Several like examples were taken in August on the mullein, *Verbascum*.



G.B.B. del. et lith.

West, Newman chromo

PLATE LXVIII.

Eupteryx stachydearum. (Page 126.)

Fig. 1.—Insect with expanded wings. The angular marks on the prothorax and the scutellum may be noted.

Eupteryx auritus. (Page 127.)

Fig. 2. — Imago, with the elytra only expanded, the confluent marks upon which may be observed.

Fig. 2 *a*.—Face, frons, clypeus, and rostrum of the same insect.

Eupteryx melissa. (Page 128.)

Fig. 3.—The V-shaped marks near the apices of the elytra are here obvious.

Fig. 3 *a*.—A pale-coloured pupa of the same.

Fig. 3 *b*.—A young larva hatched in winter on the sage.

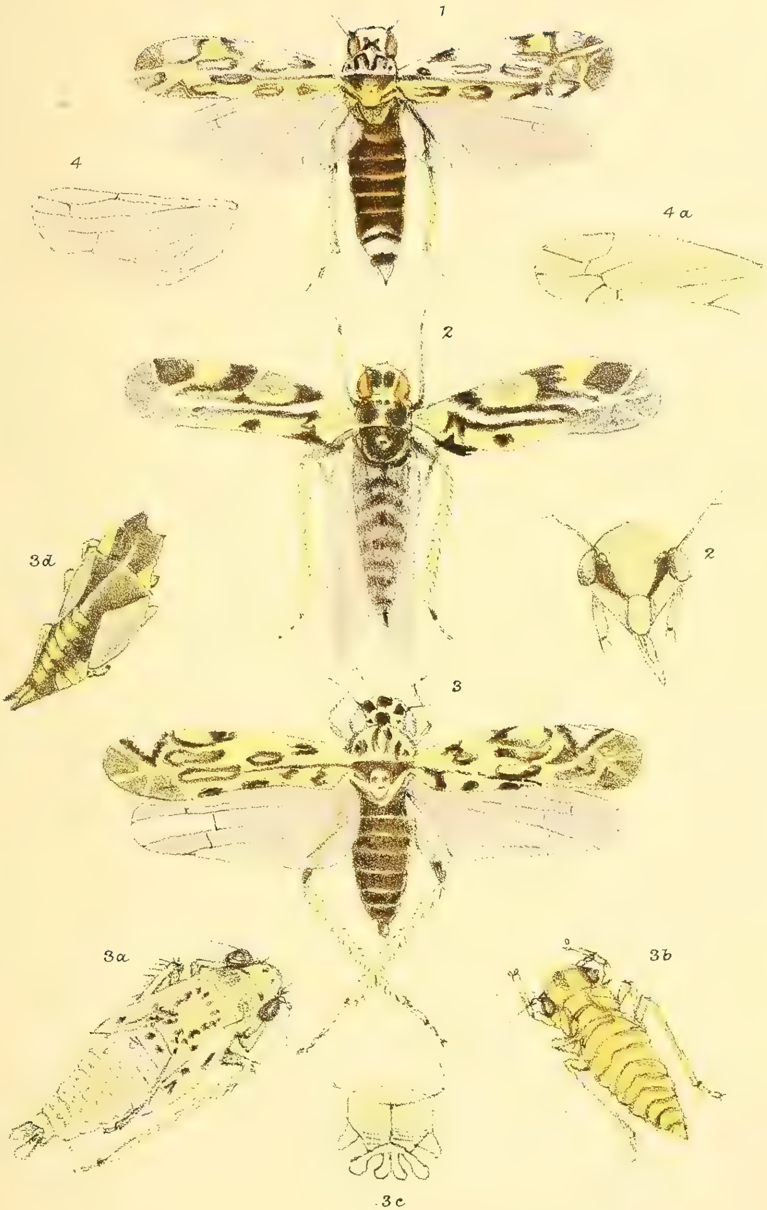
Fig. 3 *c*.—The terminal abdominal segment of the pupa.

Fig. 3 *d*.—One of many empty pupa-skins, found on the garden-sage.

Figs. 4 and 5.— The elytron and wing of *Eupteryx urticæ*. Neither limbus nor free marginal nervure here appear.

We see the presence of the latter in *Kybos* and *Chlorita*.

PLATE LXVIII.



G.B.B. del et lith.

West, Newman chromo

Dec. 1891.] [In Eight Parts.—Part VIII.

MONOGRAPH

OF THE

BRITISH CICADÆ,

OR

TETTIGIDÆ,

ILLUSTRATED BY MORE THAN

Four Hundred Coloured Drawings.

BY

GEORGE BOWDLER BUCKTON, F.R.S., &c.,

COR. MEMB. ACAD. NAT. HIST. OF PHILADELPHIA,

MEMB. DE LA SOC. ENT. DE FRANCE.

"Sole sub ardenti resonent arbusta Cicadis."

"The small becomes the dreadful and immense."

VOLUME II.

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MACMILLAN AND CO.

AND NEW YORK

1891

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confluent black triangular spots, fancifully suggesting a mask. Abdomen black, with yellow marginal edges to the rings. Legs pale greenish. Pulvilli and claws black. Elytra coloured and marked much like *E. stachydearum*, but the basal crown spot is neither X- nor V-shaped. A black V-like mark, however, occurs near the first apical cellule.

The insect feeds on various kinds of Labiatæ, such as the common balm (*Melissa officinalis*), the sage (*Salvia officinalis*), and the garden thyme (*Mentha*).

It is a hardy species, and seems to be but little affected by cold. Probably there are two broods in the year; for I have found them numerous in October nestling on the garden mint, and afterwards above the roots of the same plant throughout the whole winter into the following spring. How long each individual may live I have not ascertained, but active young larval forms were to be found during the January of 1887, notwithstanding the five weeks of snow lying on the ground, part of which time the thermometer at Weycombe had sunk to the night temperature of 11° of Fahr., or 21° below the freezing-point of water. On the dead brown leaves I also found isolated specimens of the pupa and pupa-cases, from which the imagoes seemed only recently to have emerged. I have, without success, searched for the autumn eggs, which are doubtless concealed in grooves cut in the stems of the food-plants. The thousands of round, white, scented oil-glands which cover the under surface of the sage-leaves would make it difficult, from their similarity, to see the oblong Cicada eggs, even if they were present amongst them.

The pupæ are active, pale green, and finely punctured with black. The brown exuviæ have much the appearance of the cast of a chrysalis of some minute Lepidopterous insect.

The external male reproductive organs are complex, and unlike those of *E. auritus*, its close ally.

T. Scott took this insect at Devonport, feeding on,

or infesting, the rosemary (*Rosmarinus*), which is also a Labiate plant. The Rev. T. A. Marshall pointed out the fact that the males of *E. melissæ* show no black spot on the hinder tarsi. Though this is a trivial character, it may help to separate the species from *E. stachydearum*, which has no spot.

Dr. Sahlberg does not include *E. melissæ* in his 'Ofversigt af. Cicadariæ.'

	Inch.	Millimètres.
Expanse	0·29	7·35
Body only	0·13	3·30

Genus XLVIII.—TYPHLOCYBA, *Germar*.*

Body linear and cylindrical. Vertex more or less pointed. Elytra much longer than the body, without a limbal flap, and with four well-defined apical areas. Wings show the first and second nervures meeting before the apex, and continuing, as a single nervure, to the margin. Third nervure simple, continued to the margin, but connected to the second by a short transverse vein. Fourth nervure connected with the third by another transverse vein.

This genus is equivalent to *Anomia* of Fieber. The species are mostly arboreal in their habits.

* It would much assist the memory if those who give names to the new genera they construct would, at the same time, state the derivatives of the terms they employ, if they intend them to be distinctive. It seems hopeless to assign meanings to such words as *Issus*, *Liburnia*, *Asiraca*, *Ledra*, and many others. Possibly such names never had meanings, but were meant to act as mere signs. It has been even said that in some cases the first syllables of any three words first meeting the eye in a lexicon have been cleverly jumbled together, so as to give the whole a classical appearance. The word *Typhlocyba* may have reference to the obscurely cubical forms of the head or the prothorax in some species.

TYPHLOCYBA JUCUNDA, *H.-Schäff.* Plate LXIX., figs. 1 to 1*d.*

Typhlocyba jucunda, H.-Schäff.; Flor; Kirschb.; Sahlb.; Ferrari; Fieb.; Edw. pt. ii. p. 97.
T. Zetterstedti, Boh.
Eupteryx jucundus, Marsh.

Head, pronotum, and scutellum warm ochreous-yellow. Vertex with two prominent black spots, and with one fine basal line. Pronotum with a central vertical dash, and on each side a circular spot. Scutellum with two triangular basal spots. Abdomen cylindrical, acute, with yellow edgings to the segments. Elytron yellowish, with brown apical areas marked off by broad yellow streaks, which follow the course of the nervures. Four brown dashes, of uneven length, pass to the base of the elytron, two of which are on the clavus. Wings ample, greyish, hyaline, with strong brown venations. Legs and tarsi yellow. Frons yellow, and generally with a fine brown U-shaped line, which runs from the insertions of the antennæ. Lora and clypeus rather brownish. Under side all brown, except the edges of the abdominal rings, which are yellow. The saw-valves of the female are finely fringed with setæ.

Not uncommon on *Alnus glutinosa.* Occurs as far north as Stockholm.

Length with elytra, 0·16 inch, 4·00 millimètres.

TYPHLOCYBA QUERCUS, *Fab.* Plate LXIX, figs. 2 to 2*a.*

Cicada quercûs, Fab.; Fall.
Typhlocyba quercûs, H.-Schäff.; Flor; Kirschb.; Sahlb.; Edw. pt. ii. p. 102.
Eupteryx quercûs, Marsh.
Anomia quercûs, Leth.; Fieb.

Head, pronotum, scutellum, and the ground-tint of the elytra almost white, or else pale buff. Vertex either plain or with an orange cross-streak. Pronotum with a central orange spot, half surrounded by a horse-shoe shaped yellow band. Scutellum with two reddish basal triangles. Abdomen pale brown, and furrowed. Legs pale greenish or light yellow. Clavus with three large roundish orange-red spots. Lower half of the corium with three or more large irregular patches of the same yellow colour. Apical part of the elytron with brownish areas, margined with white. Three or four irregular brown lines occur on the costa.

Rather common on oaks from May to September. Huddersfield; Haslemere; and other places.

	Inch.	Millimetres.
Expanse	0·23	5·84
Body alone	0·09	2·28

TYPHLOCYBA GEOMETRICA, *Schr.* Plate LXIX., figs. 3 to 3*a*.

Cercopis geometrica, Schrank.
Tettigonia geometrica, Germ.
Cicada lineatella, Fall.
Cicadula lineatella, H.-Schäff.
Typhlocyba plagiata, Hardy.
T. geometrica, Flor; Kirschb.; Sahlb.
Eupteryx geometrica, Marsh.
Anomia geometricá, Lethierry; Fieb.
Typhlocyba geometrica, Edw. pt. ii. p. 103.

General colour pale yellow. Vertex and pronotum almost spotless. Scutellum with a largish brown cordate mark, having an internal yellow one. Elytron with a straight and widening brown line, which divides the corium from the clavus. Apical areas fumose, and

bordered with white. Elytron often shows a faint white annulus on the costa. Legs pale brownish.

This prettily marked insect is rather uncommon. I found it usually at Haslemere on the alder. I have examples from Albury, Hertfordshire; and from Huddersfield, Yorkshire.

Length with wings, 0·16 inch, 4·00 millimètres.

TYPHLOCYBA NITIDULA, *Fab.* Plate LXX., fig. 1.

Cicada nitidula, Fab.
Typhlocyba bifasciata, Boh.
T. nitidula, H.-Schäff.; Flor; Kirschb.; Sahlb.; Edw. pt. ii. p. 103.
Eupteryx nitidulus, Marsh.
Anomia nitidula, Leth.; Fieb.
A. Norgueti, Leth.

Form rather robust. General colour creamy-white or pale ferruginous-yellow. Head and pronotum spotless. Scutellum black. Abdomen fusiform, obscurely ringed or rugose. Elytron sometimes with prominent brown nervures, at other times these are obsolete. A broad black spot runs at the base of the corium, which generally appears also on the clavus. A broad black bar crosses the corium at about one-third from the apex. Eyes reddish brown. Legs all rufous-yellow. All the under side is yellow.

This insect is liable to variation as to the barrings on the elytra.

The variety *A. Norgueti*, Leth., has two-thirds of the base of the elytral membrane filled in with dark brown.

Sometimes this insect swarms on "broad-leaved elms," but it is uncertain in its appearance. Mr. Edwards captured it also from the Lombardy poplar.

I have specimens from Foxley Wood, Norfolk, and from Tyntesfield, near Clifton, Gloucestershire.

	Inch.	Millimètres.
Expanse	0·24	6·10
Length with wings	0·14	3·66

TYPHLOCYBA AUROVITTATA, *Douglas*. Plate LXX., fig. 2.

Typhlocyba aurovittata, Doug., Ent. Mo. Mag. xii. 76, 6.
" " Edw. pt. ii. p. 99.

Head, pronotum, and scutellum greyish white, with two vertical broadish orange confluent bands passing down each. Abdomen black or deep brown, with a semilunar orange mark on the penultimate segment. Cauda and legs orange. Elytron primrose-yellow, with orange streaks and stains. Apex fuscous. A pale spot on the costa. Wings greenish-hyaline. Nervures inconspicuous.

Found sparingly on "stunted oaks in hedges" in November.

My figure is from an insect in the Douglas collection.

	Inch.	Millimètres.
Expanse	0·26	6·60
Length with wings	0·14	3·50

TYPHLOCYBA DEBILIS, *Douglas*. Plate LXX., fig. 3.

Typhlocyba debilis, Doug., Ent. Mo. Mag. xii. 204; Leth.; Edw. p. ii. p. 98.

Female. Head greyish white, with two small black spots on the vertex. Pronotum and scutellum whitish; the former with one black point on the fore margin;

the latter with two pale brown basal spots. Abdomen dilated towards the apex. Colour umber-brown, with pale edgings to the somatic rings, and a pale broad patch on the penultimate. Extreme apex greyish yellow. Legs pale, with black claws. Elytron whitish, with ochreous longitudinal dashes and fuscous apical areas. Some obscure thin and dark marks occur at the angles of the areas. Wings hyaline-grey.

	Inch.	Millimètres.
Expanse	0·36	9·14
Body only	0·11	2·79

Taken at Darenth Wood and on the Addington Hills on both beech and blackthorn; also at Norwich. In France it is said to occur on apple trees.

Figured from the Douglas collection.

TYPHLOCYBA SEXPUNCTATA, *Fall.* Plate LXX., figs. 5 to 5*b*.

Cicada 6-punctata, Fall.
Cicadula 10-punctata, Zett.
Typhlocyba 10-punctata, Flor; Kirschb.; Sahlb.
Eupteryx 10-punctata, Marsh.
Anomia 6-punctata, Leth.
A. 10-punctata, Fieb.
Typhlocyba 6-punctata, H.-Schäff.; Ferrari; Edw. pt. ii. p. 97.

General ground colour greenish white, or rosy, with the head, pronotum, and scutellum pale ochreous. Vertex with two small black dots. Pronotum with two or four spots on the anterior, and two on the basal, margins. Scutellum with two basal triangular brown spots, thus making together either six or ten punctate dots. Elytron with two more or less brown disjointed cross-bands, with a spot on the clavus. Membrane

hyaline and iridescent. Abdomen black, with the hind margins yellow. Legs very pale, almost white. The genitalia of the male are complex. The styles are crooked, long, and boot-shaped. The cauda cylindrical, tubular, apparently jointed, and capable of retraction.

Inhabits several species of *Salix*, and is in some places not uncommon.

Length of body and wing, 0·15 inch, 3·81 millimètres.

TYPHLOCYBA ULMI, *Linn.* Plate LXX., fig. 4; and Plate LXXI., figs. 1 to 1*b*.

Cicada ulmi, Linn.; Fab.; Fall.
Typhlocyba ulmi, Flor; Kirschb.; Sahlb.; Edw. pt. ii. p. 98.
Eupteryx ocellata, Curt.
E. ulmi, Marsh.
Anomia ulmi, Leth.; Fieb.

Male. Head and scutellum yellow or greenish yellow. Vertex with two black dots, and a fine medial line. Pronotum either wholly honey-yellow, or stained with a variable m-like mark. Scutellum black, bordered by yellow. Abdomen black or dark brown, with yellow segmental edgings. Legs yellow, claws black. Elytron yellow at the base, but pale and semitransparent at the apex. Areas fumose, margined with white. Wings with fine brown nervures. The penis is tubular in form, with a dilation in the midst. The orifice is furnished with three finger-like processes, like those to be seen in *T. rosæ* and others. Viewed in profile, the jointed cauda, filiform styles, and the spatulose sheaths may be sometimes seen all protruded, as drawn in my figure.

	Inch.	Millimètres.
Expanse	0·28	7·10
Length	0·10	4·00

Common on the elm, *Ulmus campestris*.

Mr. Mosley in October sent me numerous examples, crawling on the trunks of the sycamore (*Acer pseudo-platanus*) in the country round about Huddersfield.

The female is less marked than the male as to colour, and shows two larger and one smaller rusty spots on the elytron.

Typhlocyba gratiosa, Boh. Plate LXXI., fig. 2.

Typhlocyba gratiosa, Boh.; Sahlb.; Doug.; Edw. pt. ii. p. 100.
T. saturalis, Flor; Kirschb.
Eupteryx apicalis, Marsh.
Anomia gratiosa, Leth.
A. saturalis, Fieb.

General colour pale; almost white. Vertex spotless. Eyes brown. Pronotum sometimes with three obscure brown stains. Abdomen pale yellowish white, the segments being more or less bordered with brownish. Legs white, claws fuscous. Elytron pale fuscous-yellow. The apex obscurely marked by fumose areas. Clavus sometimes tinged with fuscous.

Mr. Edwards says, "not very common." Affects the beech (*Fagus sylvatica*).

	Inch.	Millimètres.
Expanse	0·28	7·10
Length	0·14	3·50

Typhlocyba Douglasi, *Edw.* Plate LXXI., fig. 3.

Typhlocyba Douglasi, Edw. pt. ii. p. 100; and Ent. Mo. Mag. xiv. 248, fig. 1, style, *l. c.*, and xviii. 224, fig. *c.*; Leth.; Fieb.

Head, pronotum, and scutellum pale umber-brown. Abdomen yellow, with fine brown borderings to the segments. Genital valves large. Elytron yellow, inclining to orange, with a faint fuscous apex. Nervures obscure and brownish, ("Elytron pale yellow, with a subcuneate spot in the apex of the branchial, suprabranchial, and subcostal areas."—Edw.) Legs pale yellow, with the ends of tibiæ brownish.

	Inch.	Millimètres.
Expanse	0·25	6·01
Length	0·12	3·00

TYPHLOCYBA PYGMÆA, *Douglas*. Plate LXXI., fig. 4.

Male. Colour uniformly of a rich golden-yellow. Vertex and pronotum unspotted, and of a pale brown colour; the lower half of the pronotum orange-yellow, marked with two obscure brown dashes. Scutellum crossed by one vertical and two diagonal brown lines. Abdomen also marked by one vertical and seven or eight horizontal bars. Apex ends with a singularly formed sheath, which contains the genital organs. Upper part of the frons orange-yellow; lower part of a greyish tint, and divided by a white line. Frons with three minute punctures. Legs all bright orange. Elytron orange-yellow, with faint brown streaks. Wings hyaline, with a yellowish iridescent membrane.

My figure of this unique insect is from a specimen, kindly lent to me by Mr. Douglas. It has some resemblance to the preceding species; but its small size and singular pygofer, amongst other variations, appears to justify its claim to be a new species.

	Inch.	Millimètres.
Expanse	0·17	4·31
Size of body with pygofer	0·05	1·27

TYPHLOCYBA TENERRIMA, *H-Schäff.* Plate LXXII., figs. 1 to 1 *b*.

Typhlocyba tenerrima, H.-Schäff.; Kirschb.; Sahlb.; Doug.; Ferrari; Edw. pt. ii. p. 99.
T. rubi, Hardy.
T. misella, Boh.
Anomia tenerrima, Leth.; Fieb.

Head, prothorax, and scutellum greyish white, and unspotted. Eyes white or brownish pink. Abdomen dark brown, with the hind margins yellow. Legs pale; claws fuscous. Elytron whitish hyaline, with three broad yellowish stripes, tapering, and finally lost at the base. Apical areas pale fuscous-brown, sometimes containing two or three blackish specks at the angles. Nervures dark for a short distance from the apex.

Common in many places on bramble (*Rubus fruticosus*), &c. Many examples were taken from bushes in the neighbourhood of Huddersfield.

Length, 0·12 inch, 3·00 millimètres.

My figure is from specimens taken whilst in conjugation, and in a singular inverted position. The genitalia are complex, both in the male and in the female. The cauda is mounted on a tuberculous process, having two inferior free processes.

Sahlberg remarks, as to the last ventral segment, "Posticæ fortiter rotundato-producto, vagina hoc duplo longiore apice exserta."

This species seems to be diffused over the greater part of Europe.

TYPHLOCYBA LETHIERRYI, *Edw.* Plate LXXII., figs. 2 to 2 *a*.

Typhlocyba Lethierryi, Edw., Ent. Mo. Mag. xvii. 224, fig. *a*.
T. sulphurella, Ferrari.
Anomia sulphurella, Leth.; Fieb.

Male. Primrose-yellow or pale orange-yellow, and without any definite markings. In some examples, however, pale brown basal stains occur on the scutellum. Frons entirely yellow. Eyes yellow, but sometimes pale brown. Three pale spots on the apex of the corium (Edw.). The only character by which this species can be determined appears to be the penis, the summit of which is divided into three branches, two of which are bifid and the other trifid, as shown by Mr. Edwards.

No outward difference can be seen between the females of this species and *T. cratægi*. Perhaps the latter are rather greyer on the elytra. Some of Mr. Douglas' specimens are more rufous in colour than others.

Common on the heights of Totland Bay, Isle of Wight; also thousands occur sometimes in August on the low bushes near moor-edges at Huddersfield.

Length of body, 0·14 inch, 3·30 millimètres.

May be taken on various trees, according to Edwards, who names the maple, hornbeam, black poplar, elm, and lime tree.

TYPHLOCYBA ROSÆ, *Linn.* Plate LXXII., figs. 5 to 5 *d.*

Cicada rosæ, Linn.
Cicadula rosæ, Zett.
Typhlocyba pteridis, Dahlb.
T. rosæ, Flor; Kirschb.; Sahlb.; Ferrari; Edw. pt. ii. p. 101.
T. lactea, Dougl.
Eupteryx rosæ, Marsh.
Anomia rosæ, Leth.

Shape narrow. Colour pale primrose-yellow. Pronotum and scutellum a shade darker. The former sometimes shows some obscure vertical bands. Elytron whitish hyaline, with a pinkish hue in some varieties. Clavus a little darker. Wings iridescent. Legs all yellow, and finely ciliated.

In some seasons this species is exceedingly common on rose-bushes, out of which small clouds may rise on agitating the branches. These insects take short flights, but eventually they return to their shelter. The parenchyma of the leaves is injured and made yellow by the punctures of their rostra; but I have noted that the upper, and not the lower, surfaces are chiefly attacked.

The males are smaller than the females, and they are less numerous. Out of sixteen insects which I examined, I counted only five males amongst them.

Sahlberg notes the occurrence of this insect on fir-trees, both *Pinus sylvestris* and *P. abies*.

My dissections for the penis agree closely with those of Mr. Edwards, who figures this organ with four leaves (see Ent. Mo. Mag. vol. xvii. p. 224, fig. *b*). The feet can scarcely be considered as provided with true claws. The tarsi end in organs more like papillæ or pulvilli.

Length of body with wings, 0·15 inch, 3·66 millimètres.

Typhlocyba avellanæ, *Edw.* Plate LXXII., fig. 3.
Ent. Mo. Mag. xxv. 158, figs. *d*, *e*, *f*.

Ground colour yellow, with the head, pronotum, and scutellum rather darker fuscous. The scutellum sometimes has yellow streaks, and two very pale vertical lines. The elytron also has an indication of a white costal spot. Frons and all underneath parts pale yellow. Legs whitish or ochreous.

A pale yellow species of *Typhlocyba* is very common on the hazel bushes (*Corylus avellana*) at Weycombe, Haslemere. I have not been able to dissect out the genitalia, but there appears to me no reasonable doubt of the identity of these insects with those first taken by Mr. Douglas at Lewisham, and afterwards described as new under the name of *T. avellanæ* by Mr. Edwards.

On July 26th, also, I took five examples of insects on the oak which I could identify only with *T. avellanæ*. One of these was a male. When the female specimens were treated with alcoholic potash, and washed with water, the details of the genitalia could be readily made out. Of these four females, one had a purse-like parasite attached below the thorax, doubtless a *Gonatopus* of some kind. The body of the Cicad was largely charged with oil-globules, but I could find no ova. These insects possibly had roved from the hazel; but there is no reason to suppose that this species only affects that tree.

Except from the varied food-plants, the insect outwardly might well be regarded as a variation from *T. rosæ*.

Length, 0·14 inch, 3·50 millimètres.

TYPHLOCYBA CRATÆGI, *Doug.* Plate LXII., figs. 4 to 4*a*. Ent. Mo. Mag. xii. 203.

Typhlocyba cratægi, Edw. pt. ii. p. 100.

Pale yellow. "A small fuscous spot in the apex of the subcostal and suprabrachial areas." Legs, claws, and abdomen coloured as in the last species. Frons prone, and somewhat convex.

This species is recorded as "not very common." However, I could have captured thousands of such insects during the month of August on the hawthorn (*Cratægus oxyacanthus*) growing in the public gardens at Great Malvern, Worcestershire.

Mr. Edwards draws the penis with two laminæ at the apex.

Length of body and wings, 0·12 inch, 3·00 millimètres.

TYPHLOCYBA SALICICOLA, *Edw.* Plate LXXIII., figs. 1 to 1*a*. Ent. Mo. Mag. xxi. 230, fig. 2*a* (penis).

I copy Mr. Edwards's short diagnosis for this species :—

"Somewhat larger and decidedly stouter than *T. rosæ*. Very pale yellowish white. Scutellum tinged with pink, at least in fresh examples. Membrane very faintly fusco-hyaline. On Sallows. Common.

Length, 0·17 inch, 4·5 millimètres.

Penis with a tuft of four falcate appendages at the apex."

The following species are considered to be distinct by Mr. Edwards. They are so similar in form and colour that no advantage will be gained by an attempt to engrave them.

Typhlocyba hippocastani, *Edw.*
Ent. Mo. Mag. vol. xxv. p. 157, figs. *a*, *b*, *c*.

For details see Plate XXIV., fig. 8, of this Monograph.

Male. Whitish hyaline. Corium tinged with yellow. Eyes grey. Tips of the tarsi black. Penis with several branched appendages.

I have examined five specimens of this insect, which were named by Mr. Edwards. They show no external differences, under the microscope, from *T. rosæ* that I could emphasize by drawing and colour. Some of the specimens are pale yellow, whilst others are more ochreous in tint. These examples show no markings of any kind either on body or elytra.

The paucity of males, contrasted with the number of females, increases the difficulty of identification of specimens, since the latter sex is stated to be of no practical value in diagnosis.

First taken by Mr. Douglas in October on the under sides of the leaves of the horse-chestnut (*Æsculus hippocastanum*), at Beaufort Gardens, Lewisham.

Mr. Edwards dissected six males, and he could find in them no individual variation in the structure of the appendages of the penis. As to the import of these organs, he considers that their "undoubted constancy" is of the "utmost value" as a differential character.

Examples of *T. hippocastani* have been lent to me by Mr. J. W. Douglas; but *T. opaca* and *T. pruni* have not come under my observation.

Typhlocyba opaca, *Edw.*
Ent. Mo. Mag. vol. xxv. p. 158, figs. *g*, *h*, *i*.

Externally in form and colour like the last, but "it may be distinguished by its dull appearance and opaque

membrane." The second apical areolet is "sessile, not stalked." Styles of the male are like those of *Douglasi*, but they are not so long. Penis appears to be without appendages.

This species also inhabits the under side of horse-chestnut leaves, and it occurs with *T. hippocastani* in October, at Lewisham.

TYPHLOCYBA PRUNI, *Edw.*

Ent. Mo. Mag. vol. xxv. p. 158, figs. *k*, *l*.

Male. White. Corium hyaline, with a faint fuscous tinge. Style much hooked, and foot-shaped.

One example taken on the plum (*Prunus domestica*) in September, near Norwich.

Before dismissing this description of the genus *Typhlocyba*, and the varied shapes taken by the penis, it will be well to notice that Mr. T. Edwards has lately extended his researches as to this organ in other genera; and chiefly from its variability in form, he has named, with diagnosis, some new species (see Ent. Mo. Mag. vol. xxii. p. 27). For reasons given, he relinquishes the genus *Limotettix* in favour of Fieber's *Cicadula*.

About these new species I am unable to express any opinion, for I have not been able to obtain specimens for comparison. The figures of the penis given are singular in shape.

As to the question how far the form of the genitalia, or parts of them, are sufficient to decide between a species and a variety, I may state Mr. Lowne's opinion (see Trans. Ent. Soc. for March 6th, 1871), who thought it probable that that which appears to be species sometimes originates from the early development of sexual organs, before the animal has acquired its adult character.

This might be described as a kind of precocity, in the contrary direction to that of the neuter or worker-bee, in which, through lack of sufficiently stimulating food,

the body is matured before the re-productive organs are completed, and thus these last remain but half developed. Some writers have further asserted, and some denied, that the greater or less predominance of a sex in a brood is governed by the character and the amount of nourishment assimilated by the larvæ. Such a cause cannot, however, be thought adequate to explain the marked paucity of males in some Hemiptera, as we find to be the fact in the Coccidæ, the Aphididæ, and, to a less degree, in the Tettigidæ.

Synoptic Table of the Genus Typhlocyba.

As an assistance to the preliminary grouping of species, the following sketch has been made upon a naked-eye view of the same. The most easily recognized insects are placed first in this list:—

Typhlocyba quercus.—Known by its blood-red, but not always similarly grouped, blotches.

T. nitidula.—Elytra nearly white: when closed, two dark transverse bands are to be seen; one below the scutellum, while the other crosses the midst of the elytra.

(*T. Norgueti* is a variety, with more confluent bands.)

T. geometrica.—Each elytron has a long, thin, black longitudinal streak near the suture.

T. jucunda.—The largest British insect of the genus. Body black. Elytra pale umber-brown.

T. sexpunctata.—Elytra more brindled than other species. Elytron, when closed, shows three obscure, broad, brown transverse bands. A black streak occurs on the occiput.

All the remaining species have pale elytra, and are not very easily separated by the naked eye:—

T. debilis.—Abdomen black. Elytra with fuscous tips.

T. aurovittatus.—Elytra more or less golden-yellow. Abdomen black.

T. ulmi.—Elytra pale, with brocaded tips. Abdomen brownish.

T. Douglasi.—Elytra with pale orange-clouded membranes. Abdomen brownish, with golden edges. Insect is rather larger than *T. aurovittata.*

T. gratiosa.—Elytra almost white, with fumose tips.

T. cratægi.—Very like the former, but smaller.

T. tenerrima.—Elytra very similar to *T. ulmi.*

The following species cannot be separated by the eye, unassisted by a lens; they are all in colour yellowish:—*Typhlocyba rosæ*, *T. Lethierryi*, *T. avellana*, *T. hippocastani*, *T. salicicola*, *T. opaca*, and *T. pruni.*

Genus XLIX.—ZYGINA,* *Fieb.*

Elytron long and without a limbus. Three longitudinal nervures nearly parallel and terminated by short transverse nervures; from the angles of which short nervures proceed to the apex, and mark out the tips into oblong unequal areolets. The first and second wing-veins unite before passing, as one, to the margin. The third vein simple, but united to the second by a short nervure (omitted in the figure). The elytra and wings often are too delicate to show the neuration.

Zygina blandula, *Rossi.* Plate LXXIII., figs. 3 to 3*d.*

Cicada blandula, Rossi; Fall.
Typhlocyba blandula, H.-Schäff.; Flor; Kirschb.; Sahlb.
T. quercus, H.-Schäff.
Eupteryx flammigera, Curtis.
E. blandulus, Marsh.
Zygina blandula, Leth.; Fieb.; Ferrari; Edw. pt. ii. p. 105.

* From the Greek, *Ζυγινος*=*Zuginos*, belonging to the hornbeam (*Carpinus betulus*).

Small. General colour pale ochreous or whitish yellow. Vertex rounded, and marked by two carmine-red spots, which in some specimens appear as lines. Pronotum with a large simple semi-lunar carmine-red spot, or divided in the middle so as to appear as two triangles. Scutellum either spotless or with one or two brown patches. Abdomen pale yellow, with reddish segmental borders. Legs very pale or yellowish. The third joint of the hind tarsus and the apex of the second, in the male, black. Elytron pale, with a long red streak close to the suture, but often this streak is broken up into five or six irregular crimson patches or into a line of crimson spots. The clavus sometimes is entirely red, at other times the colour is represented by numerous carmine-red atoms. The frons is rather long, and prone to the ground.

This pretty little insect is common in the autumn months at Haslemere and many other places. It is also common throughout France and Scandinavia. It is said to feed on various trees, such as the wild plum (*Prunus padus*), the mountain ash (*Sorbus aucuparia*), and the lime tree (*Tilia parvifolia*).

Dr. Sahlberg mentions six varieties, one of which was taken from the Scotch fir (*Pinus sylvestris*).

The genitalia are very complex. The pygofer of the male ends with two black laminæ.

ZYGINA TILIÆ, Fieb. Plate LXXIII., fig. 2.

Cicada tiliæ, Fall.
Zygina tiliæ, Leth.; Fieb.; Ferrari; Edw. pt. ii. p. 105.
Typhlocyba tiliæ, Doug.

Not unlike the last-described insect, except that the red markings are much paler, and the vertex and the pronotum are spotless; or else the streaks upon them

are almost obsolete. General ground colour of the insect very pale ochreous. Wings very delicate, and without visible veining. Hind legs long, and pale yellow. All the hind tarsi of the male black.

May be taken sparingly in the spring by beating the common ivy (*Hedera helix*).

Mr. Edwards also obtained it in nearly equal numbers with *Z. blandula* on the Scotch fir.

My figure is from Mr. Douglas's collection.

ZYGINA HYPERICI, *H.-Schäff.* Plate LXXIII., fig. 4.

Typhlocyba hyperici, H.-Schäff.; Flor; Kirschb.; Sahlb.
T. coronula, Boh.
T. placidula, Stål.
Eupteryx hyperici, Marsh.
Zygina hyperici, Leth.; Fieb.; Edw. pt. ii. p. 106.

Smaller than the last. General colour of the body pale ochreous, with a broad dark purplish brown line of variable breadth, extending from the vertex to the base of the scutellum. Abdomen pale ochreous; all the dorsal portion is occupied by a purple-brown mark extending to the tail. Saw-case black. A small red semicircular patch occurs upon the antepenultimate segment. Legs pale yellow; claws, but not the tarsi, black. Elytron pale greenish grey, and fumose at the tip and the base. The clavus is almost entirely carmine-red, with an irregular border.

This insect has been rarely taken in England. It feeds on *Hypericum perforatum*, growing in woods as late as October. It appears to be exceedingly variable in colour, some occurring without any black patch on the abdomen.

Figured from the Douglas collection.

ZYGINA ALNETI, *Dahlb.* Plate LXXIV., fig. 1.

Cicadula alneti, Dahlb.
Typhlocyba coryli, Flor ; Kirschb.
,, *alneti*, Sahlb. ; Doug. ; Ferrari.
Zygina alneti, Leth. ; Fieb. ; Edw. pt. ii. p. 105.

Body fusiform. Vertex pointed, pale ochreous-brown. Eyes pale brown. Pronotum whitish or else greenish yellow, and spotless. Scutellum yellowish, relieved by an inferior brownish angular stripe. Abdomen pointed, yellow, and obscurely ringed with grey. Legs pale yellow; claws fuscous. Elytron pointed, more or less, bright yellow in colour, and without any markings.

Taken upon the alder (*Alnus glutinosa*) from July till September. Occasionally insects have been taken on the hazel, which are so like that probably they are identical in species.

ZYGINA PARVULA, *Boh.* Plate LXXIV., fig. 2.

Typhlocyba parvula, Boh. ; Flor ; Kirschb. ; Sahlb.
,, 10-*punctata*, H.-Schäff.
Eupteryx parvulus, Marsh.
Zygina parvula, Leth. ; Fieb. ; Ferrari ; Edw. pt. ii. p. 106.

More robust than the preceding species. Vertex ferruginous-yellow, with two angular spots on the crown. Pronotum fuscous, with two, sometimes three, black spots on the fore-margin, and two on the hind. Scutellum large, streaked with reddish, with two large triangular basal spots. Abdomen dark brown, ringed with black. Hind margins pale, as also is the apex. Legs whitish, with fuscous claws. Elytron rather broad, yellowish, and rounded at the tip, which is more or less fumose or smoky. Wings delicate and iridescent.

Affects damp places, and is usually beaten out of rushes or long grass. Not common.

I have a specimen in my possession with a large blackish grey sac attached to the third ring of the abdomen, doubtless made by some species of *Gonatopus*.

On Plate LXVI., fig. 7, will be found a drawing of an insect in the Douglas collection, labelled, "*Eupteryx parvulus*, Marshall." Its colour certainly differs much from the descriptions given by others of *Zygina parvula*; but, although I have not been able to make out the wing neuration of this specimen, I have no doubt that its fitter place is with *Zygina*, rather than with *Typhlocyba*.

Zygina scutellaris, *H.-Schäff.* Plate LXXIV., fig. 3.

Typhlocyba scutellaris, H.-Schäff.; Flor; Sahlb.
,, *pullula*, Boh.
Eupteryx scutellaris, Marsh.
Zygina pullula, Leth.
,, *scutellaris*, Ferrari.

General colour of the body pale ochreous. Crown with a vertical line, with its ends dilated, joining the point and fore border of the pronotum. A spot on the disc of the crown, on each side of the vertical line. Eyes brown. Pronotum divided by a horizontal straight line, dilated in the middle towards the fore-margin. Scutellum large, with two black basal triangles, and the apex black. Legs pale yellow. Elytron delicate, hyaline, with a yellow border to the apex, the costa, the claval suture, and down the middle of the membrane. Abdomen black or dark brown. Hind margins narrowly yellow.

Obtained by sweeping fine grasses towards autumn. Dunston Common, near Norwich, &c. October. "Rather local."

ON THE STERILIZATION OF TETTIGIDÆ BY CERTAIN INSECTS.

On page 36 of this present volume, I have described some of the parasitic insects which infest the Tettigidæ; and I have also alluded to some interesting notes, made by M. Alfred Giard, which are recorded in the July part of 'Les Comtes Rendus' for 1889. The researches of this observer may be regarded as a continuation of those noted in the memoirs of Perris and of Dr. J. Mik on the like subjects.

In addition to the identification of certain parasitic species of Hymenoptera and Diptera, and an account of their several economies, our interest is excited by the recent notice of the destruction that these insects effect on the reproductive organs of their unfortunate hosts. This action appears to result in the entire sterility of the latter.

M. Giard noted that the chestnut trees (marroniers) in the garden of the Luxembourg and in those of the Bois de Meudon were attacked by thousands of small flies, most of which were found dead, and attached by their rostra to the under sides of the leaves. These insects at first were referred by M. Giard to *Typhlocyba rosæ*, Linn.; but subsequently they were identified with *T. hippocastani* and *T. Douglasi* of Edwards; with which species, externally, *T. rosæ* may be easily confounded.

Most of these insects were deformed by an attachment to their abdominal rings of a shining black somewhat V-shaped sac, very similar to that I have figured on Plate D of this monograph. M. Giard regards these cyst-like bodies as true animal galls; and he defines "les galles" as local, but persistent,

morphological modifications of organic tissue, which may be indifferently the produce of vegetable or of animal excitation. Such like deformations are commonly connected with some change of function in the parts affected. In the case of some plants the fruit becomes sterilized and altered in structure; but still it may retain a strong resemblance to the true seed. Sterility brought about through the action of one animal on another, M. Giard designates by the process, "Castration parasitaire."

One out of many instances of the excrescences made by homopterous insects, which result in a close imitation of the true fruit, may be seen in the false cones made by *Chermes abietis* on the spruce-fir. These are so similar to the true cones that close inspection alone will separate one from the other. Very curiously, the pseudo-fruit of a plant will sometimes imitate not the fruit of the particular plant affected, but that of a species belonging altogether to a different family.

Léon Dufour long ago pointed out the direct sterility of the flowers of *Verbascum* and *Scrophularia* by the action of a Cecidomyia; and M. Giard shows that a fly of the same family produces a similar effect on the seeds of *Hypericum perforatum*.

In 1857 Perris bred parasitic larvæ on several Deltocephali, which eventually spun cocoons and matured pupæ of *Gonatopus pedestris* of Dalm. From certain reasons he gives, he concluded that these insects were parasitic on other parasitic forms which had previously attacked the Tettigidæ; and that these larvæ still infested them.

The insects bred by M. Giard from *Typhocyba hippocastani* and *T. Douglasi* proved to be the hymenopterous *Aphelopus melanoleucus*, Dalman, and the perfect forms were excluded from these sacs towards the end of June. Later in the year, *viz.*, in early October, individuals of a dipterous fly were excluded from other Typhlocybidæ of the same species. These proved to be *Ateleneura spuria* of Meig., of which two generations

are said to occur in one year. It was thought probable that these insects passed the winter as pupæ within the bodies of their host, and that subsequently these Diptera assumed wings to rove and invest other Tettigidæ in the following spring. Conclusions were come to that the dipterous insects preyed on the Typhlocybidæ; but that the hymenopterous *Aphelopus* was parasitic on them, and they form the sacs, which are attached to the abdomen and sometimes to the thorax of the host.

Boheman had previously shown the parasitic habits of *Dryinus* and *Gonatopus*, and also that an economy, similar to that described by M. Giard, obtained in the dipterous gnat-like species of *Pipunculus*. Probably the generality of the Pipunculidæ are parasitic, and prey chiefly on small Jassidæ. The larva of *Ateleneura* lies within the swollen abdomen of the *Typhlocyba*, having its head turned towards the tail; finally it escapes from a rent of the dorsal part and falls to the ground, before becoming a nymph.

M. A. Giard admits a distinction between *Typhlocyba hippocastani* and *T. Douglasi* of Edwards, both of which insects feed on the horse-chestnut; and remarks that the first species is chiefly attacked by *Aphelopus*, whilst the latter becomes principally the prey of *Ateleneura*. The specific females of these Typhlocybidæ can scarcely be separated one from the other; and it would appear that sterility in this sex is chiefly shown by a partial atrophy of such parts as the saw-apparatus, which is so reduced in size and in strength as to make it incapable of cutting grooves for the eggs, should ova ever appear. In the males, the penis appears to be the organ most modified in its structure. A changed efficiency in the testes has not yet been shown. This would most satisfactorily prove a condition of sterility, or "castration parasitaire." The difficulty, however, of an adequate examination of these parts is fully recognized.

It remains yet to be explained how the destruction of *Ateleneura* is effected by the *Aphelopus*, for the latter

insect (if it follows the economy of *Gonatopus*) does not, to find its prey, quit its cyst; which is attached only to its host by a narrow communication.

It has been before noticed that the forms of certain parts of the male genitalia furnish the most direct diagnosis of the three small species of *Typhlocyba*, recently added to our fauna. A question may arise,—Do these parasites, by their action on the reproductive organs, ever furnish a pseudo-species, that is to say, simply a racial variety? If a complete sterility in such can be proved, we must conclude the above modifications of genitalia to be monstrosities. If otherwise, care is necessary that no parasitic interference has been at work to complicate the morphological phenomena before preparing the diagnoses of new species.

The economist will take some interest in the above remarks on sterility, for our corn crops are, as is well known, often reduced in quantity through the destruction of the flowers of wheat and barley by a small red Tipula or midge, *Tipula tritici* of Kirb. This gnat devours the pollen, and of course this renders the ears abortive.

In conclusion I may be permitted to quote a note, which is partly the translation of M. Giard's paper, made by Mr. J. W. Douglas:—"Important modifications are seen in singular organs not hitherto noticed, so far as I am aware, which exist in the males of *Typhlocyba Douglasi* and *T. hippocastani*, the function of which is quite enigmatical. They consist of two invaginations of the integument that divides the ventral surface of the segment of the abdomen, and reach, like fingers of a glove, up to the extremity of the fourth segment. These organs appeared to M. Giard to be homologus with the phonetic apparatus of the male Cicada. Under the name of *Ateleneura spuria*, possibly several different allied species are confounded." *

* 1. Sur une galle produit chez le *Typhlocyba rosæ* par une larva d'Hyménoptère. 'Comptes Rendus,' p. 79. July, 1889. 2. Sur le castration parasitaire des *Typhlocyba* par *Aphelopus* et par *Ateleneura.* Also p. 708. November, 1889. Par M. A. Giard.

NOTES ON THE PYGOFER OF THE TETTIGIDÆ.

It will be admitted that the significance of the complex organs connected with the reproductive system of insects is often beset with difficulty.

Much attention has of late been bestowed on the description of the multiform adjuncts to the terminal segments of the abdomen of Lepidoptera, Hymenoptera, and Hemiptera. These body-rings, or portions of them, are variously known as pygofer, œdeagus, or genital segments. The elaborate work on the American Noctuidæ, now in course of publication by Prof. J. B. Smith, is an instance of the economic importance to insects of these parts.

Dr. Daniel Sharp's suggestive memoir (see Trans. Ent. Soc. pt. iii. 1890) on the structure of the terminal segment in some male Hemiptera-Heteroptera has been already alluded to. His remarks will be seen to have some bearing on the anatomy of similar parts in the Homoptera. A review of the numerous figures I have given in this monograph relating to the pygofers of the Tettigidæ, in connection with what Dr. Sharp has written may perhaps add a little knowledge to a confessedly abstruse subject.

Fieber in 1866 published some small, but good, engraved outlines of details of the *Delphacini*, and he there included many of the external parts connected with the pygofer. In 1869 these engravings were continued throughout the European *Deltocephali* and the small Jassidæ. Much importance was given by him to the forms of the styles in the males, and these adjuncts have been since employed for specific diagnosis.

I believe that most of the genital parts noted by

Dr. Sharp, belonging to the Hemiptera-Heteroptera, may be traced in a modified form amongst the Tettigidæ: particularly this is so in the genera *Delphax*, *Liburnia*, *Deltocephalus*, and *Typhlocyba*. With due acknowledgment to Dr. D. Sharp I purpose to use such of his observations as seem to bear upon the genitalia of our British Cicadæ.

On Plate LXXV. a sketch will be found which has been constructed as an average from the details of other of my plates. It is strictly diagrammatic, and it is chiefly useful as putting into some kind of order anatomical parts, which may appear sometimes in one species, sometimes in another, or perhaps in cases where several details may appear collected in one individual.

Dr. Sharp speaks of the "rectal cauda" of the Pentatomidæ, and he thinks that it forms the termination of the alimentary canal. This appears to me highly probable. I have shown, elsewhere, that the cauda is a pretty constant appendage to the terminal segment of the Aphides, and it is almost always represented, in some form or other, in the Homoptera described in this Monograph.

Amongst other examples, the drawings given on Plate XLVI. fig. 4, Plate LII., figs. 3*a* and 3*b*, Plate LXXI., fig. 4 *b*, seem to justify the above conclusion. The cauda is obvious in *Athysanus*, *Deltocephalus*, and *Typhlocyba*. The cauda is common to both male and female insects, and in many instances the alimentary tube in both sexes can be traced to its orifice at the apex of the organ.

The rectal cauda in the Pentatomidæ is believed also to act as an operculum or protective cover to the œdeagus, but in the Jassidæ its form and small size can hardly admit of such an adaptation. The complicated structure called the œdeagus is placed below the cauda, and is of much importance, since it contains the intromittent organ which in the Tettigidæ is very delicate, and sometimes accompanied with fine and long setæ. In Heteroptera the œdeagus is

embraced by the lips of a stout wall (theca). Two lateral appendages often appear on each side of the œdeagus, which seem to be homologous with the lateral styles of the Tettigidæ.

In the last family these processes (*styles*) are mostly hooked, whilst in other cases their apices are shaped like a booted foot.

It is not clear what function these organs fulfil. In many species I believe they act as claspers, but probably they do more than this. In more than one dissection they have appeared to me to be perforated; and if they be so, in addition to their action as holders, they may pour some secretion into the vagina, Perhaps also they act as wedges or expanders of the passage through which the penis must pass. This passage must be very intricate amidst the sheaths of the saws and rasping blades, which function in the female insect both as groove-cutters and as ovipositors.

In some Heteroptera the male creeps below the female whilst coupling; but in the Homoptera the male appears uppermost, the œdeagus being partly protruded and curved downwards, in order to meet the vulva.

The inferior process is placed below, or else between the lateral processes. Sometimes this organ is double, or concave, or spoon-shaped. At other times it is simple, and forms a sheath to the delicate penis, the apex of which may be cleft into several laminæ.

Occasionally the penis is indicated by two, or else three, long filiform organs, which may be the representatives of the above laminæ, most obviously seen in the Typhlocybidæ (see Plate XII., figs. 7 and 8).

The reproductive parts of the male insect often occupy the entire space of the terminal abdominal segment. Possibly two segments are fused into one for the elaboration of the pygofer, in which cases fewer somites can be counted in the male than in the female. These body-rings of the Tettigidæ are sometimes ornamented by fringes of hair, cottony tufts, or stria-

tions. Whether or not such characters are selective or pleasing to the artistic taste of the female must be left to conjecture.

The serrated edge of the saws in the Typhlocybidæ, in all the individuals I have examined, seem to lie uppermost. When thrust out of the sheaths it is probable, therefore, that the female, whilst forming her grooves, first forces the points of the apparatus forwards into the surface of the bark or leaf of the plant. The muscles then, acting alternately on the cutting blades, would speedily form an upward slit for the purpose of oviposition. Nevertheless, I have in vain attempted to see this interesting and curious operation of groove-cutting.

It is impossible to assign useful offices to many so-called secondary sexual characters. The coloured garniture of the beak of the turkey cock and the comb of the game fowl doubtless are provocative of battle; but amongst insects we are not aware of any preference for what *we* think beauty, neither is fierce war waged amongst them for possession of the fairest.

Dr. D. Sharp thinks that, in very early times, the genital segments of insects terminated much short of their present position on the abdomen. Subsequently, the external male parts, with their surrounding chambers might have come of later growth. Such a growth, he thinks, might have "taken place *pari passu* with the evolution of the male parts, for the purpose of protection."

Amongst the Cicadæ there can be no question of the existence of interlacing and interlocking processes to the pygofer. The forcible and sudden separation of the sexes of *Cicada septemdecem* is almost always accompanied by an extensive mutilation of the parts. When once the prehensile hooks have interlaced, the insects seem powerless to alter the condition of things until the law of increase has been approximately satisfied. Thus it has happened that fossil forms in the American Florissant insect-beds remain *in coitu*. Catastrophes

came over these individuals so suddenly, that they died conjugated, and in that condition they have been preserved to present times, in the deposits of ancient calcareous mud.

I have killed, and afterwards digested in an aqueous solution of potash, conjugated examples of *Cixius*, *Aphrophora*, and *Deltocephalus*, without causing a disunion of parts. Although by such treatment specimens may be made quite transparent and supple, their apparatus is too complex and intricate; by reason of the overlying of parts, to allow drawings to be made of the interlacing of the styles. The chitinous male and female parts chiefly assist in keeping a close connexion, although in a secondary degree the softer parts do their share.

I look on these hooklets as purposive or adaptive; for it has been authoritatively admitted "that, although an organ may not have been originally formed for some special purpose, if it now serves for this end, we are justified in saying that it is specially adapted to that end."

If we exclude purpose or design in the Scheme of the Universe, we are thrown back on *spontaneity* or *fortuity*. If these words be used at all, they must always have a limited sense.* The fragment broken from the rock may be called shapeless, and its form accidental. Such a shape. however, is clearly due to laws of cohesion and conditions of stress. The same piece falling into a swirling torrent may, again by the action of simple laws, become a sphere more or less perfect, through attrition against the bottom.

The intromittent organs of Aphides, and of most other insects, are usually simple tubes. How or why these parts should assume the complexity seen in many Tettigidæ is unknown to us, and mere conjecture will lead to little of scientific value.

The effects of use and disuse, excitation and undue

* Αει γαρ ευ πιπτουσιν οι Διος κυβοι.—Soph. Fr. 763.
God's work is no mere chance.

rest, struggle and apathy, upon functional organs, muscle, and the like, have been often exampled. Mr. H. Spencer leans to the belief that functional disturbance of the nervous, and other systems, *are* transmissible by inheritance. Diminished use often means diminished size, and little exercised parts thus may become rudimentary in these particulars, from what Mr. H. Spencer calls the "inherited effect of changed structure." Atrophy in the jaws, the legs, and the muscles of lapdogs, from the cessation of struggle for obtaining their food, has been recognised; and many, though not all, biologists will think it proved "that the modified action of a part produces an inheritable effect." Charles Darwin clearly shows, in many instances, that habit, use, disuse, &c., modify both constitution and structure, and if we dismiss "logomache," this to most thinkers will appear to be a legitimate conclusion on the main issue.

We may thus conceive that, under altered circumstances of life, details of structure can somehow arise, and become permanent; and Charles Darwin, with reference to the fertilization of orchids, thought that acquired characters might finally become significant through a lengthened natural selection.*

The penis in *Pentatoma* shows itself as long, white, silvery, and filiform. In *Liburnia guttula* it also appears to be somewhat similarly shaped; or rather the penis is strap-like, and flanked by two bristly threads enclosed in a spatulose sheath. In *Idiocerus fulgidus* the penis is singularly plumose (Plate XXXI., figs. 2*c*, 2*d*).

No very remarkable divergencies have been noted in *Deltocephalus*; but Mr. Edwards has pointed out the complexity of the genitalia in the Typhlocybidæ; and he considers the fixity of forms is such that it may rise to specific value. The penis here chiefly consists of a tubular chamber, with its canal much dilated in the middle. Very generally the apparatus is crooked or

* See 'Fertilization of Orchids,' p. 288.

knee-shaped; and the end of the ejaculatory duct is fringed with from three to six laminated processes, which may or may not proceed from brachlets. Conjecturally these laminæ may function as explorers or expanders between the saw-valves.

With reference to some of the figures given in my foregoing Plates, attention may be called to the following as suggestive:—

Plate III., fig. 6. *Issus coleoptratus*. Shows the rectal cauda with its sheath (theca ?), accompanied by the superior and inferior accessory processes.

Plate IV., figs. 6, 7, 8. *Cixius nervosus*. Shows the cauda to be somewhat tubular, with the inferior accessory process tufted with cottony fibres.

Plate V., fig. 3. *Cixius stigmaticus*. Probably that part described elsewhere as the penis (*q*) is really the cauda of the female.

Plate VI., fig. 4. *Cixius pilosus*. The upper part of the figure represents the rectal cauda.

Plate VIII., fig. 11. *Delphax pulchella*. The singularly formed free styles, drawn below, may perhaps be regarded as the "inferior accessory processes" of Dr. Sharp.

Plate XII., fig. 8. *Liburnia guttula*. The spatuliform theca which protects the œdeagus is remarkable; as also is the form of the penis with its setæ. The pincer-like styles appear above. The different shapes of the genitalia of *Liburnia* show some obscure likenesses to parts of the Pentatomidæ.

My figure 2 *a* on Plate XVIII. shows two chambers to the mouth of the pygofer, accompanied by the superior and inferior processes. The central part probably is the penis.

Plate XXI., fig. 3*a*. *Stiroma straminea*. The genitalia of this species are remarkable and complex.

The pygofer of *Aphrophora* appears to be highly specialised, and the same may be said of *Idiocerus*, *Agallia*, *Euacanthus*, and *Eupelix*. These parts are more simple in *Athysanus*, but they become again

more intricate in *Deltocephalus*, and in the otherwise less differentiated Typhlocybidæ.

The division of the pygofer in the Tettigidæ by a diaphragm or wall is not often to be seen; yet the cauda is in many species isolated from the other parts by an annular wall. Possibly when the cauda is large, it may form a kind of operculum to conceal, as in *Pentatoma*, the delicate parts below it, but the pygofer is not retractile to any extent.

The power of squirting out liquid excrementitious matter may be easily seen in *Tettigonia viridis;* when the sprinkling of minute drops during a hot day may be likened to the showers of honey-dew made by Aphides.

I have never seen ants in attendance on the Tettigidæ, but they have been reported by some observers as "milking" species of foreign Membracidæ.

The genitalia of *Liburnia straminea* and *Deltocephalus distinguendus* are drawn on Plate E to compare with the genitalia of *Pœcilochroa* and *Piezosternum*, and to suggest homologous parts. Although these examples only are taken, a comparison may be continued through other species of Tettigidæ; but we have no reason to expect any exact resemblances between Heteropterous and Homopterous insects. Divergence of form probably will be more accentuated in insects collected from areas widely separated. Nevertheless, for convenience, use has been made of Dr. D. Sharp's illustrations of foreign Heteropterous Homoptera for collation with British forms. For the use of figures 9 and 11, I here tender to Dr. Sharp my obligation.

At the time of issue of the first parts of this Monograph, I had not the advantage of his memoir for consultation. On Plate E, a diagrammatic figure will be found, which may shadow forth some of those parts which appear to be homologous, or at any rate similar; and the lettering will indicate the terms which I now use for separate parts of the genitalia of Tettigidæ.

NOTES ON SOME OF THE FOSSIL TETTIGIDÆ.

Having described, however inadequately, the species of Tettigidæ now indigenous to Great Britain, it may be of interest to treat of what is known of the ancient species preserved in various rocks; but for this purpose it will be necessary to take into account the fossil remains discovered not only in Europe, but those rich materials which have been comparatively recently brought to light by American geologists. Assisted by generous money grants from the United States government, several accomplished workers on the geological surveys have enlarged our knowledge of Entomology by enabling us to compare extinct with recent forms of life.

The bibliography of fossil insects, compiled by Mr. Samuel H. Scudder, which runs 47 pages of close print, testifies to the existing mass of literature on this subject. Quite recently the same indefatigable biologist has given to science his finely illustrated volume on the 'Tertiary Insects of North America;' this, and Prof. Oswald Heer's 'Urwelt der Schweitz,' will long remain text-books, and helps to show the connection or separation of the European and American fossil insect faunas.

Prof. O. Heer's work, though published in 1865, will always be read with interest, as recounting the story of primæval life. Its clear style, well rendered into English by the late W. S. Dallas, with additional notes and effective woodcut illustrations, besides plates, will commend the volumes to both the scientific and the general reader.

In preparing the following notes on fossil Tettigidæ, I here express my indebtedness to the above important

treatises; and also to those of Brodie, Hagen, Berendt, and Goss, all of which are authoritative guides in this department of biology.

None but competent geologists can efficiently take up the task of showing the sequence of any order of life from its first appearance through its persistence to present times; and they, in their deductions therefrom, will tread cautiously when so much must rest on opinion. Still, as I have elsewhere attempted to make such a sketch with reference to the closely-allied family of Aphidinæ; whose appearance in the world seems to have been synchronous with that of Tettigidæ, I offer here a few remarks; with no special claim to originality. Notwithstanding the assurance, "Ne sutor ultra crepidam," this monograph may not be injured by an attempt to put side by side notes of some recent and fossil species.

I commence, therefore, with notices of some of the interesting examples of Homoptera, whose remains have been discovered in the older sedimentary rocks of Great Britain; and then I proceed to describe a few species of the chief genera marvellously preserved in the fossil resin, known as amber.

After a few remarks on the post-glacial age, I briefly refer to the more recent deposits in resin-anime and copal, which very well introduce us to the period when modern species come into view, and we become acquainted with living Cicadæ.

All rocks not igneous must be sedimentary, and have an aqueous origin, either marine, fresh, or brackish. The marine strata must largely predominate, inasmuch as the sea has repeatedly covered all the land. Thus as the lands now forming the continents at some time must have been submerged, it is not difficult to see why insects, the denizens of the land, have left fewer remains in the rocks than have the numerous sea animals. This paucity by no means proves that insects formerly did not swarm over the tracts of dry ground from the Devonian times upwards. It only shows that rocks of

marine origin did not preserve their remains. If we have abundant proof that beetles and other insects inhabited the shores of the lagoons and the river-swamps of the coal-measures, we may well suppose their occurrence through the periods of the formations above, though doubtless ranging under different genera and species.

Fresh-water deposits are comparatively rare, and few only are fitted to preserve the delicate organization of insects. None but the finest sediments or volcanic ashes seem to make a suitable matrix. We may except, however, the resins of amber, gum-anime, and copal. Rocks containing the iron oxides, as a rule, are destructive to organisms; thus the ferruginous clays and sandstones are poor in examples. Perhaps this may arise from the slow conversion of the higher oxides of iron into the lower, and a simultaneous decomposition of carbon contained in animal tissues. Calcareous muds and volcanic dusts are mostly free from iron compounds, and they do not offer this objection.

The larger tracts of dry land in Oligocene, Miocene, and Pliocene times were more favourable to the preservation of insects, and it is here that we have obtained our chief stores and representatives of ancient Entomology. Such stores occur in the Tertiary strata of Schambelen, Œningen, and Radaboj, the quarries of which have yielded numerous specimens to Prof. Oswald Heer; and the same occur also in those North-American insect-beds of Florissant, which have become famous through the labours of Mr. S. Scudder.

Our economic processes for the preservation of flesh, fruit, and milk testify to the long unrecognized fact that air, moisture, and organized germs are necessary to cause fermentation and decay. The controlling action of antiseptics and the influence of varied temperature is now better known than formerly. It is worthy of remark that wherever insectiferous beds have been found, the individual remains are often crowded within small spaces.

Masses of insect remains, such as these, might have been swept by a swirling stream into some quiet pool, where an abundance of fine mud in suspension might have covered them, excluded the air, and prevented decomposition. We may reasonably suppose that springs of water in the vicinity of volcanoes might be charged with sulphurous acid gas, and oxidation for a time would thus be delayed until sufficient material had accumulated to form strata of appreciable thickness. Sulphurous acid gas is known to act antiseptically by killing most kinds of bacilli.

Hemiptera are represented to have lived even in the Carboniferous times of America and Great Britain. If this be so, the family must have been contemporaneous with the gigantic Dicteoptera (cockroaches) and Coleoptera (Buprestidæ) which crawled amongst the Equisetums and the tree-ferns of that early period.

The Triassic rocks appear to have very few Hemipterous remains preserved in them; but Mr. S. Scudder has examined some fragments of wings taken from rocks below the Rhætic or Liassic in Colorado, and some elytra which are referred to the Cercopidæ. Specimens, moreover, have been referred to *Cimex* and *Cicada* in the Rhætic formations at Schönen in Sweden.

Some discussion has arisen as to the order of insects to which *Palæontina oolitica*, found in the Stonesfield slate, should be assigned. Mr. A. G. Butler, the discoverer, referred it to the Lepidoptera; but Mr. Scudder considers, and I think with good reason, that it shows a nearer affinity to the Cicadæ. I have drawn on Plate F, fig. 1, the elytron of this fine insect, which must have equalled in size any of our modern Cicadæ.

This discovery places the family Hemiptera-Homoptera far back in geological times.

Mr. R. Etheridge, Jr., in his memoir on the 'Mesozoic and Tertiary Insects of New South Wales,' has also described a fossil *Cicada*, under the name *Cicada Lowei*.*

* Mem. Geol. Survey, N. S. Wales. Palæontology, No. 72, with plates. Sidney, 1890.

Perhaps the first contribution of much value in connection with British fossil Entomology is to be found in the 'History of the Fossil Insects in the Secondary Rocks of England,' by the Rev. P. B. Brodie, and published about 1844. Previous to this, traces of insects had been found by Prof. E. Forbes, in the Hastings Sands of the Isle of Wight; and also by Messrs. W. and H. Binfield, from the Rhætic of Gloucestershire. Insects also had been found in the Wealden series of Punfield Bay, Swanage; and in the Tertiaries of Studland Bay. Collections of fossil insects, too, have been made from the Middle and Lower Purbecks, by the Rev. O. Fisher, Messrs. W. R. Brodie, C. Willcox, Capt. Woodley, and specially by the Rev. P. B. Brodie.

Prof. J. O. Westwood, in 1854, examined most of these collections, and he gave a general account of these remains, with five plates, published in the 'Quart. Journal of the Geol. Soc. of London,' vol. x.; but he remarks that as "there is not one insect entire, and not a single leg, antenna, or any trophi,—the majority, in fact, consisting only of elytra or fragments of wings,—their descriptions must necessarily be very general."

But, as to these remains, we are here more particularly concerned with the Hemiptera-Homoptera; and I reproduce from these plates a few of the most interesting examples of the Tettigidæ, referring the reader to the various papers on fossil insects contained in vols. ix. and x. of the 'Quart. Journal of the Geological Society.'

The Rev. P. B. Brodie discovered in the Jurassic Purbeck beds, amongst other organic remains, portions of the wing-covers of a small *Cicadellina*, and also the perfect wings of what appears to be a *Cercopis* and a *Bythoscopus*. They are embedded in small slabs, excavated from the Pecten- and the Corbula-beds of the Isle of Purbeck; and others were taken from Durdlestone Bay, Dorsetshire. As in some of these small slabs a large number of elytra are collected within a small space, suggestions have been made that

they formed part of the castings from the stomachs of some large birds, the horny or chitinous substance of which is well known to resist the action of many powerful solvents, and thus, as in the rejected pellets of the owls, they are voided unaffected by the juices of the stomach.

Prof. Westwood tells us that one of the best beetle-traps is a toad, in the excrement of which reptile entire specimens of "ground-beetles" may often be found.

Rhætic Formation.

Schambelen, in the Swiss canton of Aargau, is situated on the edge of the Rhætic rocks on the river Reuss. The fossiliferous strata consist of marly and slaty rocks, which stand out as cliffs. They are exceedingly friable, and by the action of wind and rain they speedily disintegrate into small fragments, which are sold for manure. The beds, originally horizontal, are now nearly perpendicular in position. One, a blackish marl, contains a remarkable number of ants, Hemiptera, and other insects, partly aquatic. There is also a fresh-water formation, but interposed between marine strata, containing ammonites, pentacrinites, shells, and fish. It is remarkable that the still-water deposits (although, so far as insects are concerned, consisting chiefly of elytra and wings even), nevertheless, retain parts of the original organic matter, and leaves of trees may be detached from the stones enclosing them (see Heer, vol. i. p. 66).

The fossil species from Schambelen number 143, of which 12 are Hemiptera, including *Cercopidium morio*, *C. minutum*, both figured in my Plate F, and three species of Jassidæ.

In some of the limestones at Durdlestone Bay, near Swanage, belonging to the Lower Purbeck series, there are numerous insect remains, which even retain traces of colour; but in Wiltshire, insects are mostly

confined to the middle division. The so-called Pecten-beds, above noted, are laminated in texture, and contain, beside insects, carbonized stems and seed-vessels of various plants. The Purbeck-beds at Ridgway, near Weymouth, are also rich in remains of insects. As many as seventy different elytra have been counted, all crowded on the surface of one small slab.*

The tables contained in Prof. Westwood's memoir may be consulted with advantage as to the exact localities from which the fossil insects of his memoir have been taken. Some general reasons are given by him for the conclusion, that the numerous insects of the Lower and the Middle Purbecks (including those of the Ridgway quarries) all belong to one fauna.

In another place I have shown that Aphides, also, are duly represented in these same beds. Similar climatal conditions obviously permitted the existence of these two insect families side by side. The examination of some hundreds of these fossil remains suggested a temperate climate, a belief which is the more likely to be true from the absence of tropical singing Cicadæ and large locusts.

The cause of the occurrence of such isolated masses of beetles, flies, and Libellulæ still rests in the same obscurity as that which led to the preservation of similar remains in the limestone of Solenhofen, and the lithographic stones of Central Europe. Although chitin is, in a sense, indestructible, it is remarkable that neither legs, bodies, nor antennæ are here preserved. At least, amongst the Coleoptera, such parts might have been expected to be preserved and united to the bodies.

* The reader is referred for more information to the Rev. J. H. Austen's list, Nos. 104, 106, 113, 116, 119, in the 'Guide to the Isle of Purbeck,' 1852.

Cainozoic Period.

Although after Cretaceous times the temperature was warm and the sea was gradually receding, the Eocene formation is singularly free from fossil insects; but they must have been abundant in the herbage that supported the Palæotherium, the Xiphodon, many monkeys, and bats allied to our Vespertilionidæ.

The Eocene clays of London, Reading, Lymington, and Alum Bay, and the Montmartre beds of France, contain leaves of figs, oaks, laurels, Aralia, Sequoia, and other plants. Insects, then, must have assisted in impregnating the flowers; and such have been sparsely found in the limestones of Bembridge and Gurnet Bay in the Isle of Wight, and also at Creech near Corfe, Dorset; more numerously still in the gypsum of Aix in Provence. In this last place discoveries have been made of Cercopidæ, Cixiidæ, and Cicadellinæ.

In the Middle Eocene we find insect remains at Marne in France; but the London Clay has not furnished as yet any evidence of the existence of Hemiptera.

The Lower Miocene (known in Switzerland as the Molasse) has been well studied by Prof. Heer, and his important memoirs form one chief source of our information as to the luxuriant fauna and flora of this period. The fossils of Radaboj in Croatia are referred to Middle Miocene times, and those of Œningen and Schambelen to Upper Miocene, whilst the extensive remains of insects at Florissant, studied by Mr. Scudder, are referred by him to the older series, known as the Oligocene.

Miocene rocks are represented in Greenland and in Spitzbergen, out of which examples of *Cercopis* and *Pentatoma* have been excavated and described. The succiniferous beds of the Baltic and Prussia are referable to this period of the Molasse. They date

just after the era of the great salt formation of Galicia in the North of Austria.

Sir Archibald A. Geikie places the amber beds of Königsberg (containing four or five feet of glauconitic sand with abundant pieces of amber, which is the fossil resin of different species of coniferous trees) in the lower beds of the Oligocene series. Below these, the Lower brown coal-series of sandstones, conglomerates and clays, with interstratified seams of brown coal, occur; in which an abundant terrestrial flora is prominent. Other beds, elsewhere, are known to consist of Pleistocene sandstones and clays, containing beetles, with lignite mixed with nodules of amber.

The vegetable origin of amber was pretty generally guessed by the ancient writers. Aristotle, Dioscorides, Pliny, and Tacitus all spoke of it; but from Martial's simile, "ut videatur apis nectare clausa suo," he seems to have considered it to be an insect secretion.

Sebastian Münster, in 1554, also wrote, "De succino quod in Prussia legitur," &c., to contain "bestiolæ, ut muscæ, culices, apes, formicæ," &c.

This particular resin has been regarded with interest on account of its electrical properties, and also as being an odoriferous ingredient in sacred incense.

The Prussian shore of the Baltic has been long famous for its amber-beds. An immense sheet of glacial ice probably, in early times, extended westwards over Europe, from the Vistula even to the German Ocean, and covered an area connected with the drainage of the present river Elbe, anterior to its present drainage into the gulf of Danzig.

Dr. A. Lissauer, of Leipsig, thinks that a bursting of the banks of the ancient Vistula may have occurred as far back as 3000 B.C.

Neolithic remains of the works of man are abundant in the old Vistula bed; and very interesting carvings in amber, representing men and animals, have been recovered from the Danzig beds. These ornaments have been referred to the stone-age of that district.

Berendt notes that such remarkable "superstitious relics" can be well compared and identified with those of Switzerland and Hungary on the one side, and those of Lake Ladoga on the other.

As I have elsewhere given an account of some of the sources of this fossil resin, there is no necessity for repetition.* It is probable that several Conifers, now extinct, exuded this resin, which is singularly hard and insoluble; but it is believed that *Pinus succinifer* of Goepert was the chief producer.

Amber of some kind is to be found over a large part of the earth's surface. It occurs in the London alluviums, the clays of the Paris basin, the Isle of Wight, and on the shores of the Caspian. It has been collected from Norway to Madagascar, and from India to Gayhead in the United States of America, &c. The insects enclosed, therefore, must have ranged over several zone temperatures, and accordingly they are representatives of many British and foreign genera.

Oligocene Period.

Mr. S. Scudder's work, already alluded to, is particularly valuable as furnishing the means for a comprehensive survey and comparison of the fossil insects of the Old and New World. In the present state of our knowledge 612 species of American fossil insects have been described, out of which the Hemiptera form the large proportion of 266 species. As Mr. Scudder assumes that the described European species number 218, the representatives of North America outnumber them by 48. There can, however, be little doubt that when the vast insectiferous beds of Western America have been examined (though so promising a field, they have been only cursorily looked into), this excess over European species will prove still larger.

One fact is remarkable, that a great number of the

* See 'British Aphides,' vol. iv. pp. 160—165.

species discovered are, as yet, only represented by single specimens; and another is, that these species can be recognized only as belonging to a single locality. Insect areas in America, it is true, are sometimes hundreds, if not thousands, of miles apart. The circumstance that these insects do not simultaneously occur, leads Mr. Scudder to the supposition that these deposits may not be altogether synchronous. From the many thousand insects passed under examination, one might have expected the recurrence of certain species; but amongst the Hemiptera, at least, such recurrent forms do not often appear, a circumstance which indicates the extreme richness of the insect fauna of this period.

An inconsiderable proportion of these fossil Hemiptera can be referred to genera now extant. "In many cases, throughout whole groups, kindred differences from modern types are found, which indicate considerable changes of structure in the intervening epochs along parallel lines." Special attention, incidentally, may be called to the structural differences between modern and fossil Aphides.

The Tertiary basin of Florissant is situated in Colorado. It is a small fresh-water lake, of about 2500 metres, equal to nearly 8200 feet above the sea-level, surrounded by granitic, trachytic, and other volcanic rocks; or by grey or drab-coloured shales. These insectiferous shales are composed of the finest sand or of volcanic dust. Their total thickness may be 15 metres, or say 50 feet. But the chief fossil riches have been taken from the strata of one of the small islets, on the shores of which originally grew gigantic trees, apparently Sequoias, the trunks of which are still standing, and show a diameter of 4 metres, or more than 13 feet. A stratum of 46 centimetres in thickness has furnished the largest number of insects; but other grey or "light-drab paper strata" are insectiferous, and they have been successfully worked. Some of these strata appear to have been cracked by the sun's heat, which

character makes it probable that the waters of the ancient lake occasionally dried up in summer.

The age of these remarkable lacustrine deposits cannot be certainly assigned; but it is believed that it is not later than the close of the Cretaceous, nor earlier than the last great upheaval of the Tertiaries, during or after Miocene times. Mr. Scudder refers them to the Oligocene.

The fauna and flora appear to agree partly with those of Œningen and of Radaboj in Croatia. Diptera are abundant, including *Bombylius*, *Syrphus*, and a host of Muscidæ. Lepidoptera are few; but there are wasps, bees, ichneumons, and examples of *Chalcis*, *Chryseis*, and *Tenthredo*. Fish, birds, feathers, and numerous plants help to make up the list of this wonderful natural museum.

Amongst the nineteen species of Hemiptera discovered by Mr. G. M. Dawson in some stratified beds of British Columbia, which are believed to be Oligocene, curiously only two species, contrary to what is usual, are Hemipterous; whilst of the Homopterous Cercopidæ we have the disproportionate number of eleven species, Fulgoridæ three, and Aphidæ two species. The dimensions of these insects much exceed the average of those known elsewhere in Tertiary times.

Our own crimson-winged Triecphora has more than one representative in the fossil state, – *Palæecphora maculata* and *Petrolystra gigantea* of Scudder; both of which insects I have figured in Plate F. The latter is nearly one inch and a half in length, and marked with three broad bands, which still retain some traces of colour.

For the diagnosis of the numerous fossil species of Tettigidæ, I must refer the reader to the illustrated works already cited, and particularly to those of Mr. Scudder. Like most other fossil insects that we have, the legs, head, and many body-parts are here "conspicuous by their absence," which, coupled with the defective and crushed condition of their abdominal

segments, I apprehend will render specific identification with fossils from distant areas very difficult. In their diagnosis, chief stress is necessarily laid on the wing-neuration, which, though fragmentary, is often very delicate and distinct.

The following modern genera are closely represented either in a fossil state, or preserved more completely in amber nodules:—*Cicada*, *Cixius*, *Olearus*, *Delphax*, *Aphrophora*, *Tettigonia*, *Bythoscopus*, *Agallia*, *Thamnotettix*, *Cicadula*, *Acocephalus*, and many foreign genera of the Fulgoridæ.

In my Plate F, fragments of some fine and large Cercopidæ are figured. They were discovered in the insect-beds of British Columbia.*

The Psyllidæ are fairly represented in rocks of the Tertiary period; but the Coccidæ have been little noted. Of other Homoptera the Aphidæ are numerous.

Miocene Period.

Before 1865, the date of the publication of 'Die Urwelt der Schweitz,' only thirty-three species of insects were known from the Miocene beds of that country; but, subsequently, Prof. Heer discovered more than 800 from the shales of Œningen near Schaffhausen alone. Of these species, 543 were beetles and 636 Hemiptera. Out of 822 specimens of Hemiptera, about 800 examples were in the larval state, amongst which there was the interesting early and single occurrence of a caterpillar; with numerous ants and grasshoppers. The presence of at least one large Cicada, and the numerical prominence of Reduviidæ, Scutata, and Coreodeæ; the occurrence of several fine species of Cercopidæ, and large water-bugs, give good evidence that a warmer climate, and especially a milder winter, prevailed over Central Europe than is now found. Prof. Heer thinks that as

* See contributions to the 'Fossil Insects of Canada,' Geol. Survey, vol. ii.

these insects undergo an incomplete metamorphosis and are more or less active in their pupal conditions, that they are better suited to countries and districts where they are not subjected to the rigours of a long and cold winter.

Œningen is situated to the north-west of Constance, on a narrow arm of the lake which discharges itself into the Rhine. The insect-beds occur in two quarries, which were the floors of former ancient lakes. In the lower quarry an extremely fine grey limestone occurs, which, although only one inch thick, may be split into 150 layers as thin as paper. These layers contain numerous sharp impressions of insects. Although so thin, the layers probably required a long series of years for their deposition, during which time the insects mixed with numerous plant remains were stored. Amidst this flora are to be found male flowers of the poplar and those of the camphor-tree, which last plant requires a warm climate to perfect them. Fruits of *Diospyros* (the date-palm), seeds of elm, and of the willow-tree also occur. Such a climate as is required by the camphor-tree of Japan and China, the fan-palm, and the elegant tree-fern, suited well the economy of gigantic insects like *Cicada emathion*, which then chirped to their mates in the foliage, just as recent Cicadæ do now in the semitropical heats and mild climates of Madeira and N. Africa.

Volcanic action was rife in many places during those Miocene days, and possibly noxious gases and acid vapours passing over large districts slew millions of insects, which, falling on the rivers and brooks, finally found rest in still water and its mud.

A highly interesting chapter on the probable climate of the Swiss Miocene will be found in Dallas's translation of Heer's 'Primæval World,' vol. ii. p. 126.

The Quaternary series of beds is singularly barren of insect remains. Probably the drifts and gravels were ill suited to preserve the insects which visited the flowers and fruits of this later period. A few

examples have come to light from the Norfolk cliffs; but more have been found at Dürnten in Switzerland, and in the lignites of Chambery.

Mr. Scudder has described two coleopterous insects from the interglacial deposits of Scarbro' Heights near Toronto. This period of the world's fauna approaches so nearly to our modern era that we may anticipate the occasional overlapping of ancient and recent species.

Sir C. Lyell pointed out, many years ago, that at the time when the Swiss lignites were forming, and the trees of the forest beds of Norfolk and Cromer were flourishing, a gradual elevation of land occurred over a large part of the North and West of Great Britain; some portions rising to the height of 500 feet above the sea-level. Subsequently this land sank, forming a veritable local deluge; and then the dry land of England, Scotland, and Ireland, and a large part of North Europe was principally represented in the form of islands, by mountain-tops. Immense glaciers slid down from the North and the West, and the attendant cold killed most of the tree- and plant-life. But again the sea-bottom was raised, and, in some places, to an elevation of perhaps 1400 feet. At this time, probably the shores of Dover and Calais were not separated by sea. Such unsettled conditions were eminently unsuited for the preservation of insect-life, and indications of their remains, accordingly, are very rare.

Ingenious speculations have from time to time been at work as to the possible existence of a vast ancient continent stretching westwards from Europe, but now submerged. Such a continent would, if it existed, help to bridge over or, at any rate, form some mediate station, and allow an interchange of the fauna and flora of the Old and New Worlds, including Greenland.

The ancient Egyptian priests taught that such a land existed beyond the Pillars of Hercules; and the Greeks, through Plato, expanded the notion into the fabled Atlantis. A recent writer states his belief that

in the islands of the Azores and Canaries we yet see the summits of the mountains of this far-off land of the golden west—the Hesperides.

Speculation apart, the general consensus of opinion amongst botanists is with Sir Joseph D. Hooker, who concludes that the ancient Greenland flora and fauna was more in accordance with a warm European than an American type. Thus the present ice-capped district of Spitzbergen once yielded flowers of the water-lily, the ape flourished, and the land was green with the Sequoia and clothed with a temperate vegetation.

A mild climate, reaching into the Arctic circle, has again been recently proved by Mr. Whymper, who not long ago described a new *Cercopium* from the Tertiary fossil rocks of Greenland.*

The Tettigidæ of these high latitudes, and those of the Baltic which have left their *identical bodies* in the amber nodules, have long been swept away by the glacial streams which covered the North and much else of the British Isles. Such intense cold must have speedily destroyed all traces of subtropical life and its attendant vegetation.

Dr. F. A. Walker, in his recent visit to Iceland, could find there no traces of Tettigidæ, although in the country round Reyhjavik he obtained several Syrphidæ (presumed feeders on Aphides) and a few Noctuæ, but no diurnal Lepidoptera.

Some have thought that the earliest types of insects must have been less specialized than those which came after. There is reason to suppose that the first palæozoic insects were four-winged; and that all their wings were of a homogeneous texture. Thus far observation shows that the Hemiptera-Homoptera occurred long before the Heteroptera, in the strata now explored. But we must remember that the Orthoptera and the Coleoptera had then coriaceous elytra and membranous wings, as now.

The general plan of wing neurations in early insects

* Phil. Trans. vol. 159, part 39, 56. 1870.

was much the same as we find it in recent families, and so much so that the ancient impressions of Homoptera will tell us as much as to their generic alliances, as recent wings now do of our present genera.

On the other hand, Mr. S. Scudder shows that deterioration or degradation obtained in geological times; and that atrophy of the two fore-legs in certain butterflies, such as the fossil representatives of the Nymphilidæ, was commencing at a period when the Florissant beds were in process of deposition.

I do not find amongst the numerous finely drawn figures of fossil Cicadæ of the United States of America any atrophy of the lower wings, which we so commonly find in living Tettigidæ, and which has become almost the rule in the modern Delphacidæ.

Notwithstanding any probability there may be that the existing orders of insects in distant times were evolved from primitive types; it must be confessed that the proof of such has not gained much, if any, strength through our more advanced knowledge of fossil insect forms. Geology has been called the archæologist of biology; but it has been many times observed that when new forms of ancient life appear in the rocks, they mostly do so fully specialized. There seems, indeed, to be no process at work which could in any way be irreverently considered as *tentative*. Long periods of time, doubtless, are necessary to form even permanent races. It is, therefore, quite useless to speculate on what might be required to introduce a new species.

According to Mr. Wm. Carruthers, the lapse of time from the pre-glacial age (roughly taken as 250,000 years) is too small to show any appreciable change in any known species of plants, that is so far as our materials admit of any comparison between them.

Dr. Schweinfurth has shown by careful comparisons that the existing Nile plants and fruits do not differ from those unrolled from mummy-clothes 3000 years old. Such plants, he says, show no marked variation.

Again, "M. Mariette has found barley in the graves of Sackhara of the fifth dynasty, 5400 years old," in no wise differing from our own. Such considerations confirm the established axiom that for us, at least, as workers in modern biology, species must be dealt with as fixed quantities.

A priori considerations might make the occupation of constructing a phylogenetic tree of Homoptera seductive, and perhaps interesting, as showing possible lines of descent; but the pitfalls are too numerous to allow of any attempt to be made here or elsewhere, from the want of adequate materials.

Tettigidæ in Amber, and Description of Plate G.

On Plate G, I have relied for typical examples, almost exclusively, on Germar and Berendt's fine illustrations of the Cicadæ enclosed in amber. Of these I have chosen, for the present purpose, only a few species out of several dozen insects engraved on their excellent plates, and these few only because they seem suited for a comparison with recent British forms. Amber specimens have an obvious advantage over fossils, from the character of the matrix. The insects are presented in a less fragmentary condition, and such fine details as hairs and setæ on the limbs are well shown when present.

Fig. 19. *Cixius testudinarius*, Germ. and Ber. This must have been a handsome insect, with its pointed vertex and elaborate neuration. The pygofer appears to be very simple. The elytron is furnished with a continuous subapical border, and the apex is cut into perhaps twenty small distinctive cellules. The wing-neuration, also, is complex. The nervures are not spotted with setigerous granules, as we see commonly in recent Cixiidæ.

Fig. 20. *Cixius insignis*, Germ. and Ber., varies much from *C. testudinarius*, both as being smaller,

flattened at its vertex, and showing wings with a different neuration. The elytron is prettily spotted, but without any continuous subapical border, and there are fewer apical cellules. Considerable differences, also, are to be noted in the wings. The five parallel bars on the pronotum, which probably are keels, recall the genus *Oliarius* rather than our modern *Cixius*.

Although these and other like examples named by Berendt certainly belong to the Cixiidæ, there can be little doubt that some such nomenclature, for those ancient insects, as *Palæocixius* would be preferable. Yet personal examination of the insects described by Berendt, and collation with foreign species, will be requisite before any alteration can be made in the generic names he gives.

The simple character of the pygofers of the fossil Tettigidæ, so far as we can observe them, lend evidence to Dr. D. Sharp's remarks that the earlier hemipterous insects probably had fewer terminal abdominal segments than their living representatives have; and that the elaborate genitalia of later times were of a more recent development.

Fig. 22. *Cixius longirostris*, Ger. and Ber. This amber specimen was wanting in many details; but its notable characters were the porrected vertex, and the long rostrum which projects far beyond the sternum of the insect.

Fig. 25. *Cixius gracilis*, Ger. and Ber. Small. The vertex much pointed. Pronotum with three parallel keels. The elytron dark in colour, and variegated with white.

Short notices of the other specimens selected will be found on the description of Plate G. For a more extended diagnosis the reader is referred to Berendt's treatise, before cited.

Copalin is a hard fossil resin, which is dug out of the blue clays of Highgate and certain sedimentary strata of India. It often contains fragments of plants

and insects. It is in composition nearly allied to amber. There is much discrepancy as to some of the sources of copal. It exudes from *Rhus copalifera* in N. America, and from *Hymenæa verrucosa*, a tree growing on the east coast of Africa and in Madagascar. It is harder than gum anime. It has a greater solubility in liquids than amber, but some kinds of copal resist the action of turpentine spirit more than others.

On Plate G, I have drawn a fine specimen of a *Cicada* which was embedded in a large piece of copal brought from Zanzibar. Other insect specimens were present in this mass, including some well-coloured dipterous and hymenopterous insects. I provisionally call it *Cicada Forsythii*, but I omit its diagnosis until more perfect materials are at hand to furnish it.

Gum anime is chiefly a Brazilian resin, but it is also gathered in Western India and in Africa from *Hymenæa courbaril.* It very commonly encloses insects and plants, all probably belonging to a recent period.

There has been considerable discussion as to the significance of the wings of *Palæontina oolitica.* I may be perhaps asked for my reasons in placing its figure on Plate F. I have done so partly on the authority of Mr. Scudder, who examined this unique fossil, and figured it in the 'Ubersicht der fossilen Insecten,' in 1885. He there groups it under *Stridulantia* (Song-cicaden). Afterwards he notes the occurrence of "what appears to be a pupal form of *Cicada* from the Rhætic of England"; and again he states his belief that the wing of *Palæontina* is Homopterous.

So far as my knowledge goes, the shape of this wing and its venation do not accord with any known butterfly. Its occurrence in strata, ages before we find the remains of flowering-plants, seems to be against such a claim. The Homoptera are apparently much more ancient than the Lepidoptera, and the Hemiptera are well recognized in the upper oolite.

The absence of discoidal cells and of a limbal edge, whilst it removes this insect from our British singing

Cicada, does not necessarily remove it from the Homoptera.

As such authorities as Butler, Westwood, Bates and others are against its Homopterous type, I do not press more than what I have said on page 176 of this volume.

The stratum there mentioned is improperly called Stonesfield *slate*. The rock has a structure sufficiently laminated to allow of its use for roofing purposes; but its composition is in no wise that of a slate.

It is remarkable, and it forms one of the problems in Palæontology, that we find certain ancient insects which seem to combine structural features, which now are the characteristics of separate modern groups; and side by side with these, "we have the apparition of modern types," which make a consistent natural classification very difficult.

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GENERAL SUMMARY.

A review of what has been advanced in the foregoing chapters lead to some concluding remarks.

The Homoptera occurred very early in geological times, and the stridulating Tettigidæ furnish us with the first examples of the group. The earliest forms as they appear in the rocks are already highly specialized, and the species in many instances are as large as, and in some larger than, the known recent forms of Europe and Africa.

The record of fossil insect-life is very defective, from the nature of the remains and the unsuitableness of most rocks for their preservation. Evidence, however, so far as we have it, does not show a transition of species into species; neither can we yet learn much of the Phylogeny of Cicadæ from the few fossil larval forms at our disposal; nor can we yet add much to the interesting question of degradation of organs.

We have not been able to trace the early simultaneous rising of brachypterous and macropterous conditions of the imagos, as seen in our recent Delphacidæ; for the number of larval examples at our disposal are too few for us to argue, from their absence, that degradation had not commenced. However, Mr. Scudder has recently pointed out that such a process of abortion, in the fore-legs of some genera of fossil butterflies, was in operation in early times.

Although Cercopidæ were very common and of large proportions, we are ignorant if they then practised the singular habit of secreting and hiding themselves in spume. Such testimony from the rocks of this mode of concealment would have been of high import, as bearing on the question of acquired habits and hereditary tendencies.

The *proximate* causes of variation are within the powers of scientific investigation, and perhaps also of solution; but the *ultimate* cause must be beyond the scope of finite reasoning. Science is engaged in thrusting back, as far as possible, the final but necessary resort to the act of a *primus motor*.

The pilot of the steamship in the storm battles first with the sea waves, and only in a secondary manner does he regard the wind, which has caused the upheaval of water. But in quiet he may reflect on the sources of wind, and consider the different densities of air over large regions, which initiate the cyclone. Pushing thought farther back, he may refer to the powers of the sun, and finally to cosmic forces, whatever they may be. Recognizing our limited capacities, here we reverently rest, and consistently refer all beyond to the will of the one *Causa causarum*.

Many may regard rest as the final or normal condition of matter, and say that nothing moves except through the agency of force or forces applied. Yet we may equally well assume motion or life to be the ruling condition of things, and that rest in the universe is abnormal. Thus we can take exception to the old poet's dictum that—

"Death is king of all."

Life acting with or against purely chemical forces, may be regarded as synthetic, and its agency on organisms as modifying, restoring, and even preventing the ordinary changes called decay, which may be considered as an analytical process.

Biological variation may thus be approximately defined, but not explained, as the result of the action of life on the delicately balanced forces of very complex organisms, whose parts are retained in unstable equilibrium. This action is concerned in selecting conditions favourable to growth, in repelling those tending to chemical decay; and in the unconscious choice and adaptation of parts for producing and perfecting

the initial or reproductive cells of the individual. We may suppose a species constant until some disturbance of forces affect the very unstable equilibrium of an organism. This would produce variation.

Physicists have made us aware of some of the phenomena of tension connected with liquid surfaces like those of the soap-bubble when exposed to media of different densities. The walls of a cell, or series of cells, might be similarly acted upon by media of many temperatures, by electrical conditions, and other forces; and such one or more cells would be differentiated from others not so exposed to the like strain. New functions might arise with their concomitant changes. Though the above can be no explanation, it might indicate one of the proximate conditions of variation.

It has been nowhere proved that the Aristotelian idea of a vital principle, as something either superadded or something distinct from matter, is an erroneous idea; or that his opinion and that of his school is illogical, or that the actuality of the intellect has nothing in common with corporeal actuality.

"Kein Phosphor, Kein Gedanke" is rich in unproved assertion.

Profs. Agassiz and Quatrefages believed in the immutability of species. The former, like Charles Darwin, thought that the question of crossing and infertility had no bearing on the rise of species. Prof. Quatrefages holds that the distinctive phenomena between race and species furnish the means of recognizing between them; for, whilst the fertility, *inter se*, of the former is undoubted, the *persistence* of hybridism through crossing, *inter se*, has never been proved.

Without wishing to enter on debateable ground, the author thinks that the facts of fertility and infertility ought to have a chief position in the determination of species. It is obvious that persistent infertility must eliminate one or both elements of doubtful forms, and eventually prove such to be mere "sports" in breeding;

whilst few would deny the inferences from the facts of a persistent fertility.

The evidence from the rocks must be looked upon, *pro tanto*,—rather as negative to the transmutation of species. But biological phenomena, like many other phenomena, require often only a modicum of time for showing results. In the insect world one might well marvel (except that the fact is so common) at the wonderful atrophy of the alimentary organs, tracheæ, and legs of the caterpillar, and the simultaneous developments of wings, ocelli, and reproductive parts in the pupation of some butterflies, which changes sometimes require only four or five days for completion. Phenomena like these may give consistency to a belief in sudden leaps, with no perceptible transition, from one generation to another. M. Naudin and other competent thinkers have discussed this point, and Darwin does not entirely ignore such a possibility of sudden bounds.

Without prejudicing the question one way or the other, Prof. Ray Lankester's remarks may be summarized, though they were not used by him for the same purpose. Some animals which ordinarily, in allied species, pass through a larval stage, may in certain kinds miss this stage altogether. Thus some of the little tree-frogs have no tadpole forms. "There are instances in which the most important part of the recapitulative phases are absent from the developmental history of an animal. All the wonderful changes in an animal's ancestry may be completely omitted."*

Thus, granting the possibility of the transmutation of species, numerous intermediate links might be passed at a bound, and hence their absence in the rocks. The question, however, may be asked, Why is this absence of transitional forms the rule, and without perhaps an unchallenged exception?

In relation to the above remarks on the phenomena

* See 'Degradation,' Prof. E. Ray Lankester, p. 53.

of variation, it may be remembered that Heraclitus, ages ago, stated his theory that all things are perpetually in a state of flux. In his obscure manner he says, "Nothing is, but is always becoming;" and, again, that the notion of life implies alteration, and it presents itself to us as a condition of change.

Words are but counters, dimly expressing our ideas. The word creative is repugnant to the minds of many when it implies that cause and effect as regards physical matter are synchronous. "Creation" may be adequately replaced by almost any word that does not preclude a conception (feeble though it be) of the awful Unconditioned, operating through laws in sequence.

We are compelled to take time and its lapse as a necessary factor in all phenomena, yet independent abstract thinkers have conceived an idea of the past, the present and the future as if one and the same.*

> "For was, and is, and will be, are but is:
> And all creation is one act, at once,
> The birth of light. . . . . .
> Thus
> Our weakness somehow shapes the shadow,
> Time.

The above remarks seem to be in accord with what Mr. Gladstone wrote in 1885:—"Not that I have the horror with which some men of science appear to contemplate a multitude of what they call sudden acts of creation,—meaning, I suppose, the act which produces something not connected by an unbroken succession of measured stages." . . . "A series with development gives to design a wider expansion and an augmented tenacity." ('Nineteenth Century,' Nov. 1885.)

As to the existence of such hidden links, we may well ask, with Chaucer,—

> "Why then should witlesse man so much misween
> That nothing is, but that which he hath seen"!

Prof. Poulton, Mr. Merrifield, and others have so recently discussed what conditions of environment

* See Prof. O. Lodge's Address to the Physical Section of the British Association at Cardiff, in 1891.

affect or promote variability in the colouring of insects, what are the effects of insular habitats in causing darker prevailing tints, the action of low temperature as to the controlling periods of pupation, and the like subjects, that only a few remarks will suffice relating to the special subject of Cicadæ.

As to insular habitats, I have received from Ireland many specimens of Aphrophoræ, Bythoscopidæ, and Deltocephali, which are striking from their dark and pronounced colouring. There is cause for regret that so little interest has been hitherto shown in working out the Hemiptera of our sister island, and that not very much more has been bestowed on North Britain. The Coleoptera and Lepidoptera of this country (we may say also on the Continent) have absorbed more attention perhaps than can be well spared, whilst other insect orders have had but few to devote themselves to describing their remarkable economies.

As to protective-mimicry in animals, and variation connected with concealment, notwithstanding that so much has been written, much yet remains in doubt and obscurity. Abstract æsthetic notions of beauty can hardly be claimed for insects; indeed we cannot easily define them for ourselves. The male of the silkworm moth pairs as freely with the female having crippled or undeveloped wings, as with the imago of perfect form. With reference to colour, we do not certainly know that the eyes of insects at all appreciate the characters of the waves of light in the manner we do. Insects may be partially or wholly colour-blind, as often occurs amongst the highest animals. But the notion of warning-colours of course recognizes an appreciation, which Sir. J. Lubbock did not find so easy to prove active in the case of the honey-bee.

We have yet to balance evidences on both sides. Lepidoptera, as a rule, are not fearful of showing their bright hues, and becoming conspicuous in broad sunshine; and the same may be said of our bright-coloured spiders, which usually spread their webs in the most open spaces.

After all, it is not proved that birds are the natural enemies and captors of winged diurnal Lepidoptera. The dragon-fly will catch such insects on the wing, nip off their wings and devour their bodies; but such is not a common sight with reference to birds.

However, there can be no doubt that the Tettigidæ often in their colourings closely assimilate with the plants they affect. Some animals have special organs (chromatophores) through which they are able to vary their colours at will; but insects do not appear to be so endowed, and their changes of colour must be sought from other causes.

Prof. Poulton thinks that colour in insects never arises from selective agency; but that larvæ are often sensitive to colour-surroundings, and nymphal colouring is often due to larval susceptibilities.

An unconscious change of colour, dependent on light, may be exemplified in the trout, which, captured in some Irish deep loughs, are very dark and almost spotless, whilst those taken in the neighbouring tributary streams are bright and silvery.

Mr. F. Pascoe comes to the conclusion that, as a rule, insects trouble themselves very little about concealment.* Yet the beetle drops to the ground if approached, and the *Cicada* ceases its chirp, and finds a concealment so perfect that even clever trackers mostly fail to discover the insects which obviously are close at hand. It may be doubted if any change of colours would secure insects from the marvellously acute vision of the water-wagtail or flycatcher on the feed.

The very close resemblances between the Tettigidæ themselves, if they could be shown to be voluntary in the insects, might be called mimicry. Some instances of close resemblance between species of different genera have been already alluded to. As in other orders of insects, this curious faculty of simulation is not always equally carried out in the two sexes

* The 'Darwinian Theory,' p. 93.

of a species. Facts like these are difficult to reconcile with a protective theory, except by somewhat complicated arguments which require certain assumptions.

General Remarks upon the Distribution and Habitats of Tettigidæ.

The flora and fauna of a district obviously must have a biological connection between them, for one forms the chief food of the other. Some Cicadæ are confined to certain localities from the circumstance that their peculiar food-plants there flourish. It is not, however, safe distinctively to name insects from the particular character of their food; for altered circumstances sometimes compel changes, which may make such specific names misleading. As an illustration, *Aphrophora alni* may be abundantly taken on *Viola canina*, *Rubus fructicosus*, *Vesicaria rubra*, and even *Pinus sylvestris*, as well as on *Alnus glutinosus*. *Philænus spumarius* of the allied genus will blow up its froth on almost any leaf sufficiently succulent.

Dr. J. Sahlberg, at the commencement of his 'Ofversigt,' ranges the Cicadariæ under heads, showing different localities, but this is chiefly for the convenience of searching for the live insects. Amongst these habitats the following grouping will be worthy of notice, since it relates either to local species or to those of less common occurrence in this country:—

Pine trees and firs (*Pineta*). *Eupteryx Germari*, *Typhlocyba rosæ*, *T.* 10-*punctata*, *Thamnotettix abietina*, *Zygina blandula*.

Woods (*Nemora*). *Ledra aurita*.

High hills (*Alpes*). *Thamnotettix torneella*, *Stiroma albosignata*, *Limotettix* 6-*punctata*, *Euacanthus interruptus*.

Sandy shores (*Litora arenosa*). *Deltocephalus sabulicola*.

Marshes (*Paludes*). *Olearus leporinus*, *Delphax pulchellus*, *Paramesus phragmitis*, *Liburnia longipennis*.

Dry meadows (*Prata arida.*). *Eupelix cuspidata, Megophthalmus scanicus.*

Heaths (*Ericeta*). *Asiraca clavicornis, Ulopa reticulata, Stiroma bicarinata.*

Sahlberg adds to these habitats: — *Luci, Lacus, Campi, Saliceta, Culta*, and *Loci uliginosi.*

Other habitats I have noted in the diagnosis of species.

As to distribution of the Tettigidæ, fossil forms show that formerly the family extended over wide ranges of the earth's surface. Although our notices are very scanty as to the distribution of recent forms, they are obviously scattered over the continents of Europe, India and China, Africa and North America. Extraordinary forms of Centrotidæ and other subfamilies of Membracidæ are met with in Mexico; but they yet want describers.

At present we do not know much more than the fact that at Simla and on the slopes of the Himalayas, where the oak, the chestnut, walnut, beech, ilex, conifers, and other trees of semitropical growth flourish, stridulating Cicadæ are common, and, doubtless, many other divisions of the same group may be found. The singing sorts are few on the plains, but they appear in the hills about July, and continue their din more or less for four months, and then they somewhat suddenly disappear.

The Rev. F. A. Walker made some interesting captures of *Triecphora sanguinolenta* at Aceldama in April, and at Ephesus in Asia Minor in May, 1886.*

The Tibiceninæ, Cicadinæ, Membracinæ, and Fulgorinæ are in great measure confined to hot climates; but the Cercopinæ and Jassinæ seem to be almost everywhere present. In Great Britain we have no recorded examples of the Lystridæ, Derbidæ, and Flatidæ.

By far the larger number of British Tettigidæ occur during the summer and autumn months, but some

* See 'Proceedings of the Victoria Institute,' March, 1887.

few species resist the cold of our most severe winters, mostly resorting then to the roots of small shrubs and plants. *Typhlocyba melissæ*, *Dicraneura mollicula*, and *D. variata* will hybernate in the imago state under the snow; and *Athysanus melanopsis* may be captured on the bare hills at Haslemere during the cutting winds of early March. Climate and approximation to the sea probably modify colours in the smaller Tettigidæ.

During the present month, November, 1891, I have received from a friendly correspondent some singularly bright examples of *Euacanthus interruptus*, *Eupteryx auritus*, *Bythoscopus flavicollis*, and *Limotettix virescens*, captured near Edinburgh. Also, from the same gentleman, some captures, in Elginshire, of *Thamnotettix cruentata*, the markings and colours of which might almost suggest a new species. Their pronota have broad transverse bars, and are rich in fine red spots; whilst the wings are of a glancing steel-blue, not to be seen in my figure.

From another correspondent I have received several Cicadæ from Cushenden, near Antrim in Ireland. They, as a rule, are darker in tone, and are more strongly marked than the English insects of the same species.

A naked-eye view of these small Hemiptera gives an inadequate idea of their true colours, and these tints are not much improved by the use of a single lens. It is only when the insects are examined with a three-inch or long-focussed objective on a good microscope, with the light of a daylight condenser, that their striking colours and markings can be appreciated.

Many of my figures have been drawn from type specimens, some of which are rather faded. Delicate colours, like green and some yellows, fly by age, whilst the reds and browns are more persistent. Thus recent specimens will be found sometimes to out-do my representations of them, which, as a rule, are not too bright; for the beautiful half-tints of the insects can be only fairly shown by lithochrome processes.

Mounting and Preserving Cicadæ.

More than one method may be employed for preserving and storing these insects.

The small Tettigidæ are very sensible of heat, and they may be killed by a temperature much below that of boiling water. The contents of a sweeping-net may be exposed for a few seconds before the fire of an open grate, and then the specimens may be shaken out on a sheet of white paper, and grouped into genera and species with the aid of a camel-hair pencil.

For their preservation we may imitate the natural process of enclosure in amber, by the substitution of Canada balsam for the fossil resin. When successfully done, the very small details of the objects will be preserved for a hundred years or more; but from the difficulty of examining such objects in all positions, this useful mode must be considered only as a supplementary help towards identification.

Small slips of card, all cut of the same length and each pierced by a *small* pin, will be found convenient in practice. Specimens also may be mounted on pieces of clear mica, but such mountings do not often allow good views of the under sides of the insects.

Gum tragacanth is almost insoluble in cold water; but if some fragments be steeped in it for a few hours a transparent jelly or mucilage is formed, which has the useful property of drying into a thin film, without gloss. A small lump of this jelly placed on each strip of card will make a good attachment for any insect which is pressed into it. This plan has the advantage of allowing a subsequent detachment of the object by plunging all into cold water, when the mucilage will swell up as at first. A short pin thrust through the card does not hinder the use of comparatively short-focussed objectives, which a large pin certainly would do.

A few drops of a solution in water of mercuric-

bichloride will keep tragacanth-mucilage, in stopped bottles, free from fermentation for many months.*

Naphthaline, melted and cast into small blocks, will be found very efficacious in preserving museum specimens from both mites and mildews.

Some regret must be expressed that it has not been possible to draw the figures on my plates magnified to one scale. Obviously the same amplification necessary to bring out the details of a small *Eupteryx*, if employed to figure a *Centrotus*, would wholly fill one plate. The amplification given by a 3-inch objective is too great for all large species; and a combination to form a focus of 4 or $4\frac{1}{2}$ inches, even if such would suit the stage of the microscope, would be somewhat difficult to acquire.

I have found the following adaptation very convenient, when the camera lucida is to be used; and it involves little or no expense from the optician.

A double *concave* spectacle lens may be chipped into a circular form, fixed in a short tube or collar, and then temporarily slipped over the nose of the weakest objective. The focal length of the objective then will be increased, and, if required, it may be still more lengthened by placing another fragment of spectacle lens in front of the former piece.

Such a combination of course is not optically perfect; but for most purposes, such as for drawing, the method will be found both practical and efficient.

* To do away with the annoyance of broken corks and sticking stoppers to bottles containing gums, varnishes, and the like, small pieces of window-glass, of three-quarters or one inch square, may be pressed on the open necks of the phials. If moistened with the gum or varnish they will effectually close the bottles, and their removal is very easy by a knife.

Additional Notes on the Significance of the Tettix represented on many Classic Coins and Gems.

In the Introduction to the first volume, the above subject has been partly discussed. The interest excited has resulted in several literary contributions from friends, which seem to be of sufficient importance to be noticed here.

Mr. H. G. Dakyns has called my attention to the first coin engraved in Mr. Percy Gardner's 'Types of Greek Coins.' I quote what Mr. P. Gardner says of this coin:—

"We have from Caulonia, at this period (about 500 B.C.), what must be considered one of the most interesting figures which have reached us from the Greek cities. A standing figure advances, entirely unclad, towards a stag, which looks back to him as if claiming protection, or welcoming his approach. In his right hand, which is raised, is a branch, perhaps of laurel; on his left arm, which is extended, runs a little figure, naked, with winged feet, and holding a branch in each hand. The head of the smaller figure is turned backwards. To detail all the explanations which have been offered of this group would be a long task. That the central figure is Apollo may be considered fairly certain. His attitude towards the stag may be supposed to be that of protection. But the smaller figure is an enigma."

Several theories are then propounded, especially that of Mr. Watkiss Lloyd (to which Mr. Gardner inclines), that the large figure is Apollo Catharsius, the cleansing-god; and that the smaller figure is the wind, with which he cleanses the air. Others have interpreted the figure as *καθαρμος* or *δειμος*.

Mr. H. G. Dakyns, on the other hand, in consideration of the Tettix appearing on other coins of Caulonia, suggests that this figure of an old man, with his

bald-head and long beard, may be the humanized Τεττιξ. He remarks that, "Tithonus, loved of the divine Eos (or Aurora), forgetting to ask from her youth besides immortality, became old, and old had to remain."

> "Me only cruel immortality
> Consumes: I wither slowly . . . .
> A white-haired shadow roaming like a dream
> The ever-silent spaces of the East,
> Far folded mists, and gleaming halls of morn."

as our own poet has sung.

Some have thought that Tithonus perished into the Tettix on hearing of the death of Memnon,—the son of himself and Eos the Dawn.

Plato, in the 'Phædrus' (262), calls the Tettiges Μουσῶν προφῆται; and reports Socrates as saying, "A lover of music, like yourself, ought surely to have heard the story of the grasshoppers, who are said to have been human beings once"; and then follows the story of their rhapsody over music, and their deaths through thirst and forgetfulness of eating. But now, dear to the Muses, they hunger no more, neither thirst any more, but are always singing from the moment they are born; and in heaven they report to Terpsichore of those who love the dance; to Erato, of the lovers; to Calliope, the eldest of the Muses, and to Urania, of the votaries of philosophy; and so to the others. "For these two last are the Muses who are chiefly concerned with heaven, and thoughts divine, as well as human; and they have the sweetest utterance. For many reasons, then, we ought always to talk, and not to sleep, at mid-day." (See Jowett's 'Plato,' vol. x. p. 136).

In the Imhoof collection there is another coin of Caulonia of later date and finer execution. It represents Apollo with a *Cicada* (which was sacred to himself) in the field. The nearly naked figure holds a laurel twig in his uplifted right hand, and his left extended towards a buck. There is no running figure, as in the older coin; but its equivalent possibly is, as Mr. Dakyns suggests, the before-noted *Tettix.*

Fig. 7, Plate H, is copied from Mr. Gardner's fine work; and Fig. 6 is from Blumer and Otto Keller's equally fine phototypes of the coins and classical gems in the Imhoof museum.

Caulonia was an ancient Greek colony in Italy, mythically founded by Typhon; and its chief town was noted for its salubrity and its strong breezes. It was destroyed in the Pyrrhic war.

The projecting nose, the almond-shaped eye, and the figure partly designed in profile and partly frontwise, are sure indications of the archaic manufacture of the older coin, the age of which has been estimated between B.C. 550-431. Devices on the fields of ancient coins were not always the same. Such might be a Tettix, a crayfish, a locust, a scorpion, a fish, &c.

Probably the Syracusian die-sinkers excelled all others in their appreciation of arts, as adapted to their purposes of coining and gem-cutting. The wheel, moistened with emery-powder or some other cutting substance, probably was early used in die-sinking. Indentations also were made by the punch, marks from which are often visible on old coins, which become more particularly evident at the terminations of the letters. Subsequently the wheel gave way to the graving-tool, and hard alloys and iron were incised as now, for constructing the dies.

It is remarkable that amongst the animals enumerated by Mr. Gardner as stamped on coins, the Tettix does not appear; and in only one of his fine illustrations does he show the bee. This last insect is characteristically traced on the Ephesian coin which appears in his plate. It may be recognized by its small eyes, its short wings, its prominent sting, and the wing-veining.

Although no Greek dies for stamping have been discovered, there is no doubt that many coins were made by placing round pieces of gold or silver between dies, and by one or more blows of a heavy hammer the metal was forced into the depressions. Such

rough methods will explain the irregular forms and the eccentricities of the effigies so often seen, and caused by the shifting of the blanks. Sometimes the upper die was "incused" or roughly made in relievo, which would insure the softer metal being forced into the details cut in intaglio. The Greeks used gold, silver, electron (an alloy made of these last two precious metals), and bronze. The inscriptions on their money in many cases read backwards. Whether such coins were ever used as signets does not clearly appear.

Fig. 6, Plate H, is copied from Blumer and Keller's work, which contains 1352 phototype illustrations.*

Fig. 1, Plate H, represents a tetradrachm of Messania, with a hare and a *Cicada* below.

Fig. 5, Plate H, represents a coin of Larissa, showing a horse which apparently has been stung by a scorpion, stamped above (*Tettix enalios*, a sea-tettix or crayfish?).

On Plate I, vol. i., will be found representations of an Athenian tetradrach, and also two small bronze coins with Cicadæ.

The graceful fables, spun out of the brains of the ancient poets for the amusement of their admirers, of course soon got woven into the beliefs and superstitions of the vulgar. Gems containing Cicadæ were cut for ornaments of the person, and perhaps for charms, and stones were engraved in intaglio to be used as signets. The grotesque occasionally appeared in the devices of the former articles, a good example of which may be seen in Fig. 2 of my Plate H. It has been copied from King and Munro's 'Horace,' London, 1869, p. 338, note, p. 452. It is there described as a locust driving a plough, drawn by a yoke of Cicadæ.

This insect, the Italian *Cigala*, may be distinguished from the bee, which it much resembles in glyptic

* See 'Types of Greek Coins in the British Museum,' &c., by Percy Gardner, M.A., Cambridge Univ. Press, 1883. See also, 'Tier und Pflanzenbilder auf Münzen und Gemmen des Klassischen Altertums von Imhoof.' Teubner in Leipzig.

representation, by its disproportional head, large eyes, and above all by the strong nervures traversing the wings.—*Onyx.*

From the same source, also, I have copied a gem which shows a lioness, which has whelps, as is seen by her teats fully distended with milk. She lifts one paw, as if sporting with one of her litter. The *Cicada* in the field, in combination with the lioness, may have at first conveyed to contemporary eyes an intimation of locality, to which no clue now remains; or else a pretty allusion to the musical reputation of the lady who used the gem for her signet.—*Sard scarabæus.*

Fig. 4, Plate IV. Carnelian from the Berlin Museum. A singing *Cicada* lying on its back. Very good. Explained, however, by Tölken (viii. 357) to be the pupa of a water-insect.

There are other coins of Athens with representations of the *Tettix*. One is of bronze, with Apollo nude, holding figures of three Graces in his right hand and a bow in his left. A *Cicada* in the field on his right, shows his attribute as the song-god. A *Cicada* appears also on a coin of Amphipolis, which doubtless here is a magistrate's symbol.

Figs. 8, 9, 10, represent a *Cicada* finely and cleverly worked in chalcedony or onyx, the white streaking of which helps to imitate the natural markings of the insect. The gem is drilled so as to permit its suspension from the neck of a wearer, doubtless as a charm. Dr. John Evans, who kindly lent me this finely-polished specimen from his collection of classical antiquities, gives the period B.C. 300 as the probable date of workmanship. From Avezzano. Lago di Fucino in Central Italy.

The survival of the beliefs of ancient days amongst the peasantry of a country, and the interweaving of mystic ideas of the long past with modern superstitions, are subjects of great interest and worthy of research. With the unlettered the symbol soon loses its original significance; and then it grossly takes the place, or

wholly thrusts out the abstract ideas connected with its origination. If any object then happens to be mystic or shows any charm of the supernatural, the peasant is liable to retain hold of it, and thus it becomes woven into his hopes and fears, and partakes also of his religion.

Mr. Charles G. Leland has investigated some of the surviving beliefs of the peasantry of North Italy, and the districts representing the ancient Etruria. Very liberally he has put me in possession of some of the facts which he has accumulated, connected with the survival of the spirituality of the *Cicada*. He informs me that the "*Cicada*, *Grillo*, locust, and grasshopper are to the peasantry of modern Tuscany (Etruria) completely confused into one, as regards traditions. Even the Italian dictionary makes them synonymous."

"One day in the year all Florence is occupied with catching, or buying and selling in small cages, the *Grillo* or black cricket; and the little illustrated newspapers of the day are full of pictures referring to it, mostly with obscene allusions, because there are slang words of a phallic nature similar to the name *Grillo* and its cage."

The "*Cavelletta*" is a beautiful grey insect, the largest of the species, with leaf-like wings. It is a great favourite with the peasantry, and it is considered by them to be luck-bringing. It confers wisdom, æsthetic culture, poetry and song in children. Mr. Leland says that the insect is known in America as the "Katydid."

When a *Cavelletta* enters a room where a child is sleeping, the mother catches the insect, ties one leg with a long thread, attaches the other end to the bedpost, and chants certain verses, which Mr. Leland translates as follows:—

> "O Katydid, as good as fair,
> Who brings good fortune everywhere;
> Since now into this house you've come,
> O bring good fortune to my home,

Unto me and everyone,
But most of all unto my son!
Bring it unto me, I pray!
Do not take the least away.
In life you were a lady, full
Of talent good, and beautiful;
Let me pray, as this is true,
You'll give my child some talent too;
And when you fly from East to West
May you in turn be truly blest.
For though an insect form you wear,
You're still a spirit good and fair."

When the child shall be old enough to understand this, he shall repeat, whenever he sees a *Cavelletta* (Io son giovane e vero):—

"I am but little, as you see,
And yet I may a genius be!
And if when grown I shall be great,
And make a name in Church or State,
I'll not forget that one fine day,
As I in cradle sleeping lay,
How all my wit, as mother bid,
Was brought me by the Katydid."

In modern Tuscany there are unmistakable traces of all the ancient attributes ascribed to the *Cicada*, *i. e.*, prophecy (μαντεία), art, knowledge of the future of children, derived doubtless from the association in art with the *Tettix*, and the grasshopper with Cupid. The Tuscan peasantry still allude to the myth that Cicadæ were maids before the Muses, and that Apollo turned them into insects.

Explanations of such survivals will appear, Mr. Leland informs me, in his forthcoming book on 'Etrusco-Roman Remains in Tuscan Tradition,' "which will contain much lore connected with the ancient gods and invocations to them."

The above traditions of the *Tettix* are from the peasantry living in Tuscan Romagna, lying between Ferli and Ravenna.

The singular attitude of the *Mantis*, resting on its four hind legs, with its fore legs raised, and having the tibiæ pressed together, suggests to the peasant the act

of prayer. He may sometimes be heard to address the insect to this effect, "When thou prayest, insect! pray for me!"

Mr. Wallace speaks hopefully of the future as to our being able, as the rocks are better searched, to find examples of the ancestry of insects far back in geological time. The unexpected discovery of insects of high type and greatly specialized forms in Palaozoic strata, shows the great antiquity of orders which already had acquired their chief characteristics. Such a discovery renders all speculation as to the origin of true insects premature. We must go much farther back even than to these early times to find ancestral forms. Mr. Wallace, however, concludes that the geological difficulty has now disappeared; and that the noble science, when properly understood, affords clear and weighty evidence of evolution.*

Montaigne, cynically quoting Juvenal, says:—

> "Let patients in great doubt,
> Seek great Physicians out."
>
> "Curentur dubii medicis majoribus ægri."
> Juv., *Sat.* 13, 124.

In making such a quotation, however, we would not imply that the study of Geology gives no support to the doctrine of the transmutation of species. We only state our hesitation to accept the idea, except "by authority," that the geological difficulty has now been disposed of.

To conclude. Natural science has the supreme advantage over all other science in being inexhaustible. The collateral interests and questions which arise are on every side demanding attention and answers.

The present volumes may be thought discursive as a Monograph. The author is painfully sensible of errors both of commission and omission; but it is offered to lovers of nature more as a contributory

* See 'Darwinism,' p. 409.

treatise than one exhaustive. Thus it may serve as an invitation to country ramblers to pass into one of the many comparatively untrodden paths of insect research. New species will, doubtless, discover themselves to those who are not despisers of small things; and such forms will try their powers of discrimination and comparison.

I tender my thanks to many friends and correspondents who have given me suggestions and help. Amongst them I particularly name Prof. Rupert Jones, who read my proofs on fossil Tettigidæ; to Mr. Leland, Mr. Dakyns, Mr. Upcott, and to others who have not been specially noted in my preface or text.

An apology is due to the reader for my omission of the Greek texts of some of the Anacreontic and other poems in which the *Cicada* is lauded. Such additions were contemplated in my Introduction, but other matter has caused this volume to be sufficiently bulky.

Few chapters in Mr. Wallace's work on 'Darwinism' will be read with greater interest than his last. The question of the rise and development of organized material forms, has not been restricted to the consideration of such forms but has already passed into the far more difficult region of Psychology. This certainly is not the place to enter on ground, thought by many to be debatable; but in passing by such discussions, we may say that whilst energy is not gross matter, so Will and Choice are not energy.

In conclusion I quote the words of the Duke of Argyll, which speak so hopefully of man's future, and his possible attainments:*—

"Nothing is more wonderful in the human mind than that it is conscious of its own limitations. The bars to our knowledge, against which we so often beat in vain, are bars which could not be felt at all, unless there were something in us which seeks a wider scope.

* 'Contemporary Review,' December, 1880. Duke of Argyll.

Limitation in the lower animals is complete, and they have no consciousness of the fact." Our thirst for more light virtually expresses the belief "that we could understand, if some higher intelligence would explain it to us." Will the Great Artificer bring his own chief work to intellectual confusion?

ERRATA AND CORRIGENDA.

Vol. I.

Page lvi, for "*Lipori*" read "*Lepori.*"
Page lvii, ,, "*Lipari*" ,, "*Lepori.*"

Vol. II.

Page 51 *et seq.* The genus *Deltocephalus* should have been numbered XXXVII., and the numbering of subsequent genera should be in sequence. There are forty-eight genera, and not forty-nine, as would appear from the last (*Zygina*) being numbered XLIX.

Description of Plates.

LXII., LXIII., LXIV., for "*Dicranura*" read "*Dicraneura.*"

DESCRIPTION OF PLATE E.

(Called PLATE LXXV. on page 157.)

The reference-letters on these figures, as a rule, correspond to similar parts of the other figures, except in figs. 9 and 11, which have the lettering originally assigned to them by Dr. Sharp in his illustrations.

Fig. 1.—The pygofer of *Typhlocyba Douglasi*, showing the barbed styles of the male and its adjuncts. These parts have been dissected, after treatment with aqueous potash. *l, p.* Lateral plate. *p.* Penis. ? *s.* Style.

Fig. 2.—The styles isolated and more magnified, with a central horny process. Below, at 4 *a*, there appears a dilated tube, ending with a clubbed setæ, which may perhaps be considered as the penis.

Fig. 3.—A profile view of the female pygofer, showing, at *c*, the cauda, which *may* be capable of protrusion. *l, p.* Lateral plates, below which the saws are seen.

Fig. 4.—Termination of the cauda, which is tufted, and apparently perforated.

Fig. 5.—Terminal abdominal joints of the female of *Zygina blandula*. Profile view.

Fig. 6.—The same parts seen from below, with its valves, *v*.

Fig. 7.—Diagramatic sketch, showing certain details of structure in the pygofer, which might appear either singly or collectively in species of Tettigidæ. The drawing has been made to assist in the nomenclature of parts, and to help in finding homologies. *c.* Cauda, as in *T. rosæ*. *d.* Diaphragm. *f.* Filaments of penis, as in *Liburnia guttula*. *h.* Horny plates, as in *Liburnia straminea*. *l.* Lobes, as in *Dicraneura*. *p.* Penis, as in *Idiocerus fulgidus*. *s.* Styles, as in *Typhlocyba rosæ*.

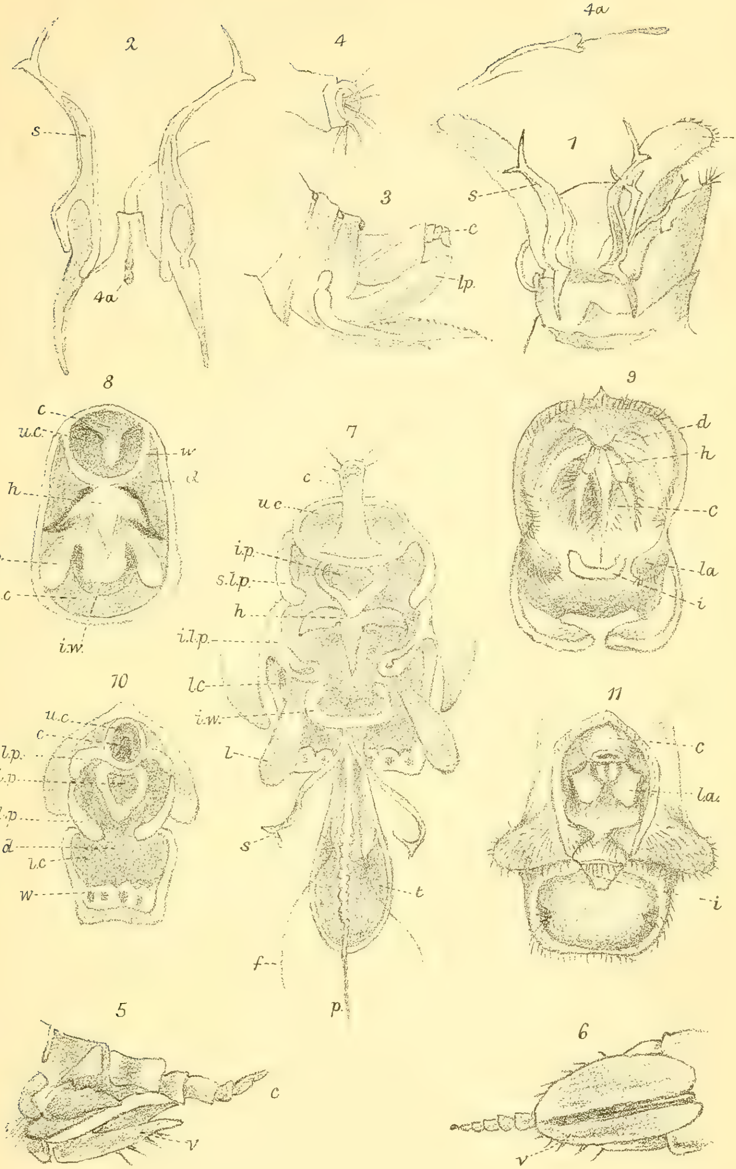
t. Theca, as in *Liburnia guttula*. *w*. Walls enclosing the details of the pygofer. *i, l, p*. Inferior lateral process. *i, p*. Inferior caudal chamber. *i, w*. Inner wall of lower caudal chamber. *l, c*. Lower caudal chamber. *s, l, p*. Superior lateral process. *u, c*. Upper caudal chamber.

Fig. 8.—Pygofer and adjuncts of *Liburnia straminea*, placed here for comparison with the œdeagus of the next figure. Lettering as in fig. 7.

Fig. 9.—*Pœcilochroa hardwickii*. Parts "seen from behind. *l, a*. Lateral appendage. *d*. Diaphragm. *c*. Rectal cauda. *h*. Horns attached to cauda. *i*. Terminal orifice of cauda." Figure copied from Dr. D. Sharp's illustration.

Fig. 10.—Œdeagus of *Deltocephalus distinguendus*, seen from behind. Certain homologies appear with the next.

Fig. 11.—Œdeagus of *Piezosternum subulatum*, viewed from above. *c*. Cauda retracted and elevated. *l, a*. Presumed lateral lobes of œdeagus. *i*. Inferior accessory process. Also copied from Dr. D. Sharp's illustrations. See Trans. Ent. Soc. of London, *l. c.*



G.B.B. del. et lith.

West, Newman imp.

PLATE F.

FOSSIL TETTIGIDÆ. (Pages 164—180.)

Fig. 1.—Elytron of *Palæontina oolitica* of Butler. Drawn of the natural size.

Fig. 2.—Wing of *Cicadellium psocus*, Westw. From the English Purbeck beds.

Fig. 3.—Elytron of *Cicadellium dipsis*, Westw. From the same place.

Fig. 4.—Elytron of *Cercopidium Signoreti*, Westw.

N.B.—Figures 2, 3, and 4 are enlarged from the small engravings of Brodie.

Fig. 5.—Upper side of *Cicada emathion*, Heer. From the Swiss Miocene.

Fig. 6.—*Cercopium minutum*, Heer. From the same place.

Fig. 7.—*Cercopium morio*, Heer.

These last three figures are from Die Urwelt der Sweiz.

Fig. 8.—Body and elytra of *Agallia obstructa*, Scudd. The elytral venation is suggestive of our own modern genus.

Fig. 9.—Fossil remains of *Petrolystra gigantea*, Scudd. From the Oligocene of Colorado. The expanse of this fine insect must have been more than 2½ inches.

Fig. 10.—A nearly complete example, but wanting the limbs, of *Palæcphora maculata*, Scudd. This insect has dark irregular patches, instead of the bands which mark our representative *Triecphora*; the crescentic black edgings of the recent species are here represented at the elytral tips.

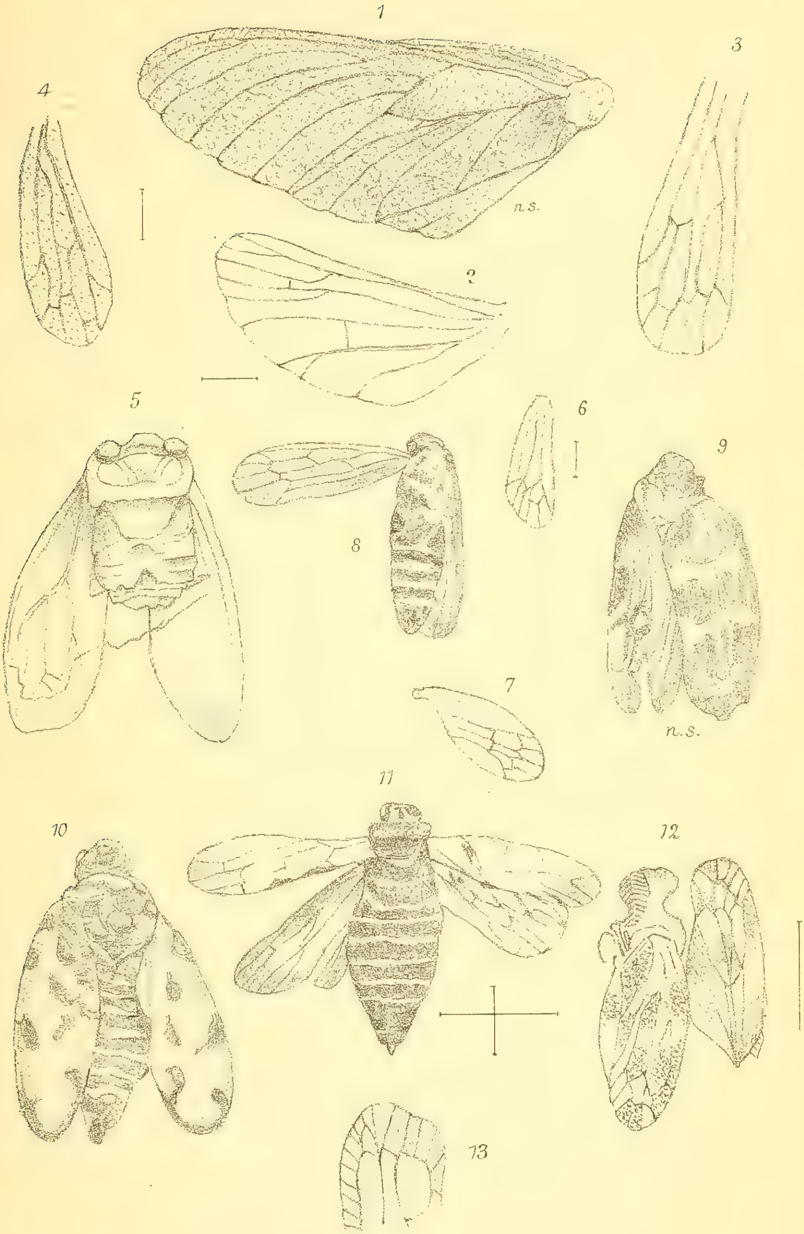
Fig. 11.—Fossil remains of *Thammotettix gannetti*, Scudd. Probably the body of this insect has been

compressed. The wing-nervures are very similar to those of our modern genus.

Fig. 12.—Fragmentary parts of *Dawsonites veter*, Scudd. One elytron is perfect. The venation to a certain extent recalls that of *Athysanus*, but the limbus is wanting. A trace of brown colouring matter still remains in the matrix.

Fig. 13.—Apex of an elytron of *Stenecphora punctulata*, Scudd. The membrane seems to have been stippled, or covered with dots.

My figures from 8 to 13, inclusive, are copied from illustrations in some one or other of Mr. Scudder's memoirs. The last three insects are from the tertiary beds of British Columbia. The other insects are from Colorado.



G.B.B. del. et lith.

West, Newman imp.

PLATE G.

Tettigidæ in Amber. (Pages 181—183.)

Fig. 2.—*Typhlocyba resinosa*, Germ. & Ber. Characterized by a want of ocelli, by an elliptical under side, and by the vertex being somewhat arcuate, and by the strongly spurred hind tibiæ.

Fig. 9.—*Typhlocyba encaustica*, Germ. & Ber. Lower border of the pronotum emarginate. Elytra somewhat rounded, each having a white costal spot, which is still preserved on the elytra of some recent species of *Typhlocyba*.

Fig. 11.—*Jassus immersus*, Germ. & Ber. Nearly allied to *Jassus sulphurella*, but it is larger, and apparently differently coloured. The specimen is obscured by an opalescent film. Fig. 11 *a*.—The antenna. Fig. 11 *b*.—The elytron. N.B.—This species would appear to be more nearly allied to *Bythoscopus*.

Fig. 13.—*Tettigonia proavia*, Germ. & Ber. Head obtusely acute. Pronotum puncto-striate. "Seems to be in close relation to North American and Brazilian species." Rather longer than our *Tettigonia viridis*. Fig. 13 *a* and fig. 13 *b* probably are the larva and pupa of the same species. The ocelli are prominent in these last insects.

Fig. 19.—*Cixius testudinarius*, Germ. & Ber.

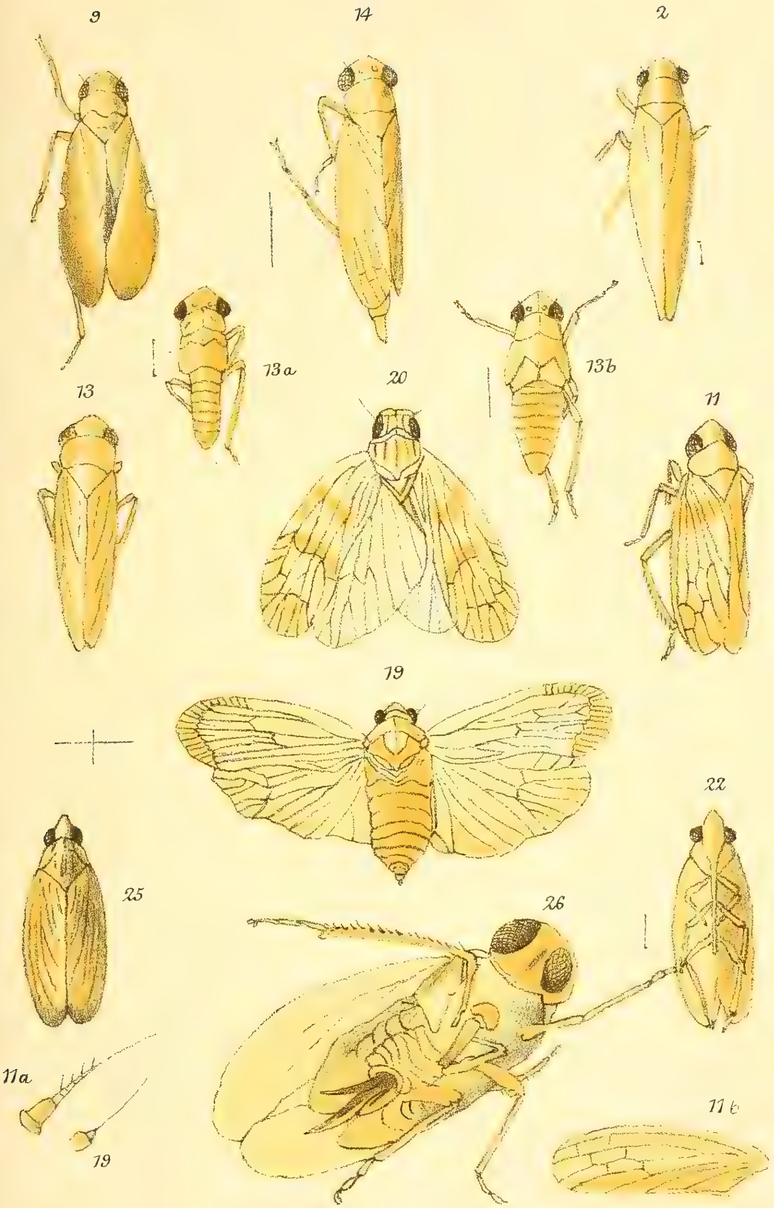
Fig. 20.—*Cixius insignis*, Germ. & Ber.

Fig. 22.—*Cixius longirostris*, Germ. & Ber. This specimen was wanting in many details, but its porrected vertex and long rostrum may be noted as distinctive.

Fig. 25.—*Cixius gracilis*, Germ. & Ber. Upper side.

Fig. 26.—*Cicada Forsythii*, mihi. Enclosed in copal-resin. From Zanzibar. Details only of the under side have been made out. The outline of the frons and clypeus have been lost.

PLATE G.



G.B.B. del. et lith.

West, Newman imp.

PLATE H.

Coins and Gems containing Figures of Cicadæ.
(Pages 197 to 201.)

See also Vol. I. p. xix, and PLATE I.

Fig. 1.—A hare, springing to the right. Underneath a *Cicada*. Messanion. Reverse: Mule-drawn chariot in motion. In the division, a laurel-leaf with berries. Tetradrachm of MESSANION. Imhoof Museum.

Fig. 2.—Gem. Grotesque. A grasshopper driving a plough, drawn by Cicadæ.

Fig. 3.—Gem. Sard-scarabæus. A lioness, with a *Cicada* on the left.

Fig. 4.—Singing *Cicada* lying on its back. Very good. Carnelian from the Stockholm Museum.

Fig. 5.—A horse licking its right fore-leg. "Above, a *Cicada*." (*Scorpion?*) Reverse: LARISAEON, and a sandal in a deep square. Drachm of Larisa of Thessaly. Brit. Museum.

Fig. 5.—Naked male figure, holding a laurel-twig in his right hand: before, a buck; behind, a *Cicada*. Reverse: KAULONIATAN. A buck facing to the right. Nomos of Caulonia. Arolsen Museum.

Fig. 7.—Naked male figure, in a position similar to the last described. A running figure on the left arm. A buck below, facing to the right: KALOI. Nomos of Kaulonia.

Figs. 8, 9, 10.—*Cicada* cut in onyx, and drawn in different positions. Fig. 10 shows how a silk cord might have threaded this ornament for suspension round the neck.

With the exception of figs. 8, 9, and 10, all my figures are either from King and Munro's 'Horace,' or from Percy Gardner's 'Types,' or from Blumer and Keller's 'Münzen und Gemmen Klassischen von Imhoof.'

G.B.B. del. et lith.

West, Newman imp.

PLATE LXIX.

TYPHLOCYBA JUCUNDA. (Page 131.)

Fig. 1.—Imago. The anal nervures are strongly developed.

Fig. 1 *a*.—Front view of the head, with upper part of the legs.

Fig. 1 *b*.—Under side of the female, showing the ciliated saw-valves.

Fig. 1 *c*.—Hind legs of the same insect.

Fig. 1 *d*.—End of the fore-tarsus, with its blunt claws.

TYPHLOCYBA QUERCUS. (Page 131.)

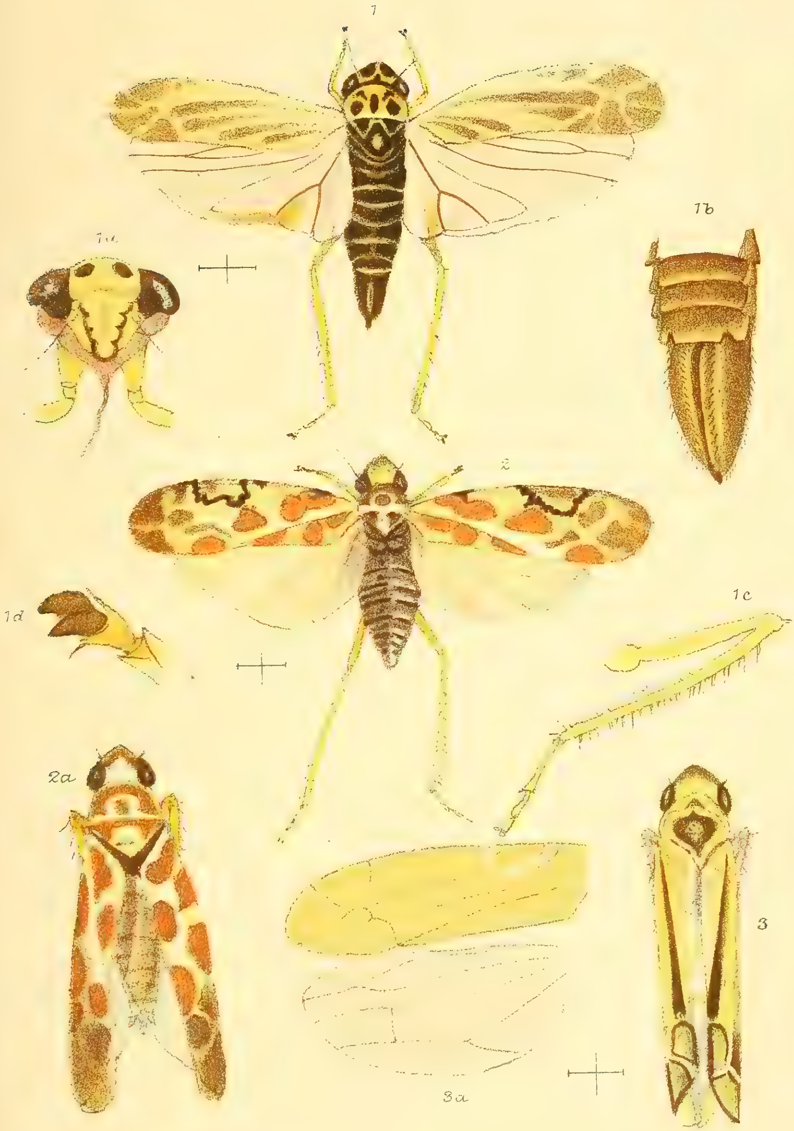
Fig. 2.—Imago. The wing-veins are invisible.

Fig. 2 *a*.—Variety of the same insect.

TYPHLOCYBA GEOMETRICA. (Page 132.)

Fig. 3.—Imago, with closed wings.

Fig. 3 *a*.—Elytron and wing of the same. The faint annulus on the costa may be traced in several other species.



G.B.B. del. et lith.

West, Newman chromo.

PLATE LXX.

TYPHLOCYBA NITIDULA. (Page 133.)

Fig. 1.—Imago. The three elytral radials are often strongly marked. The bars are not constant in form.

TYPHLOCYBA AUROVITTATA. Page 134.)

Fig. 2.—Imago of the same.

TYPHLOCYBA DEBILIS. (Page 134.)

Fig. 3.—Imago. The lower abdominal segments are sometimes dilated.

TYPHLOCYBA ULMI. (Page 136.)

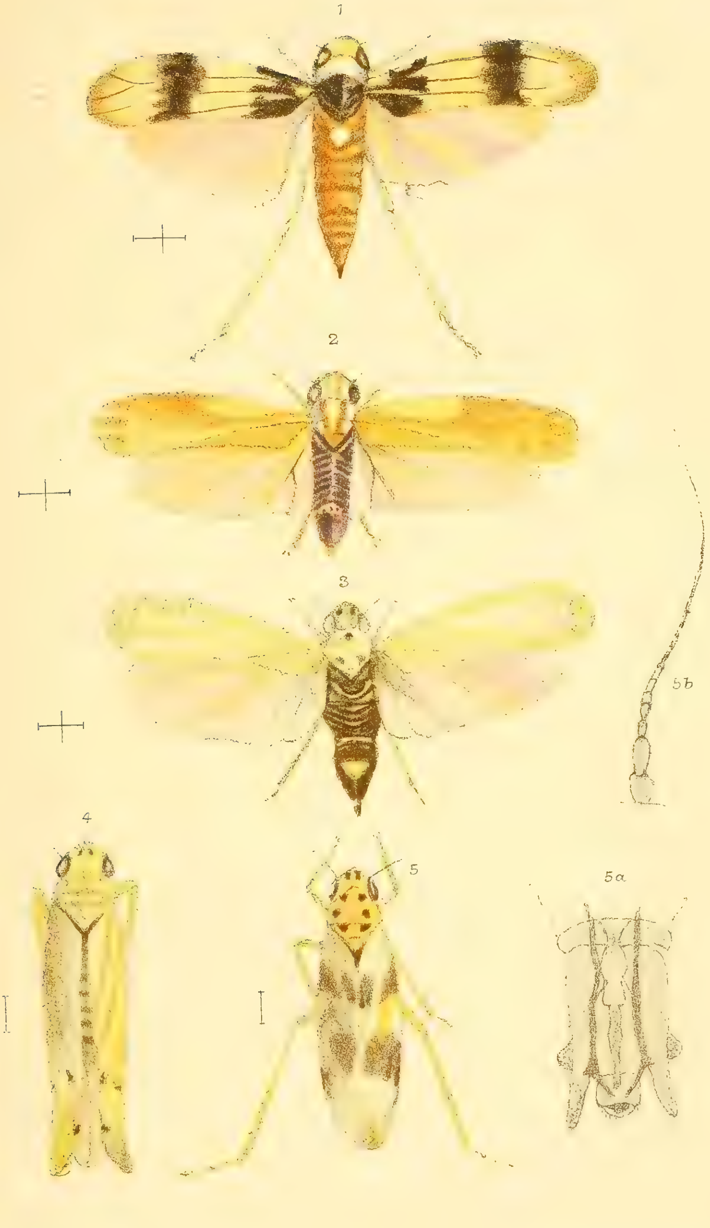
Fig. 4.--Imago of the male, with closed wings.

TYPHLOCYBA SEX-PUNCTATA. (Page 135.)

Fig. 5.—Imago of the male. The bars on the elytra are often disjointed.

Fig. 5 *a*.—The antenna, which shows the compound nature of the seta.

Fig. 5 *b*.—Male genitalia. The styles are visible through the integument, and the cauda is seen between the lateral plates. The penis apparently lies between the styles.



G.B.B. del et lith.

West, Newman chromo.

PLATE LXXI.

Typhlocyba ulmi. (Page 136.)

Fig. 1.—Imago of the female.

Fig. 1 *a*.—Penis, with its dilated channel and its tentacular extremity.

Fig. 1 *b*.—The profile view of the terminal segment.

Typhlocyba gratiosa. (Page 137.)

Fig. 2.—Imago. The wing veining is very delicate.

Typhlocyba Douglasi. (Page 137.)

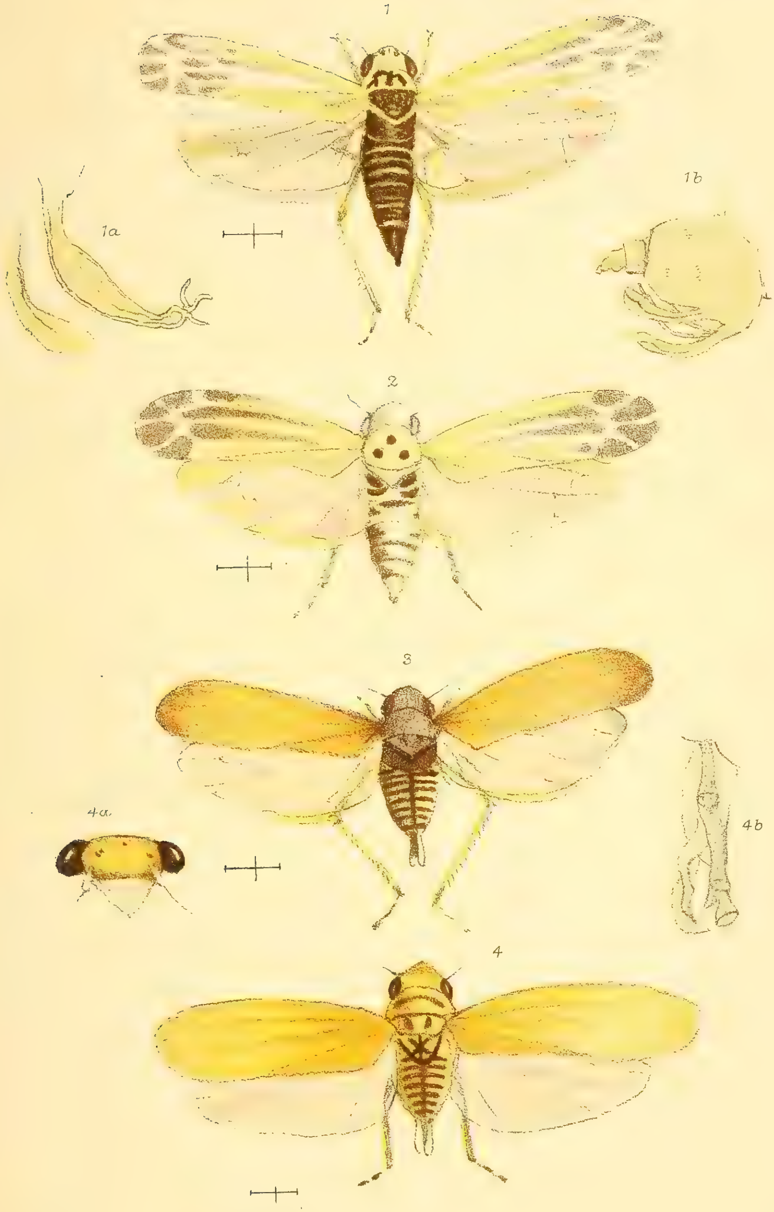
Fig. 3.—The venation is generally obscure, particularly on the elytra.

Typhlocyba pygmæa. (Page 138.)

Fig. 4.—The imago of the male. The genitalia, with the almost transparent theca, are peculiar in form.

Fig. 4 *a*.—Head, showing the unspotted frons and the greyish clypeus; and the antennæ with dilated basal joints.

PLATE LXXI



G.B.B. del.et lith.

West, Newman chromo.

PLATE LXXII.

TYPHLOCYBA TENERRIMA. (Page 139.)

Fig. 1.—Male and female conjugated.

Fig. 1 *a*.—Pygofer, with its singularly erect cauda and valves. Seen in profile.

Fig. 1 *b*.—Valves seen from below, with part of the styles.

TYPHLOCYBA LETHIERRYI. (Page 140.)

Fig. 2.—Imago, with closed elytra.

Fig. 2 *a*.—Head, with frons and rostrum.

TYPHLOCYBA AVELLANÆ. (Page 142.)

Fig. 3.—Imago. There is a tendency to show the costal annulus, which is also visible in some amber specimens of Typhlocybidæ.

TYPHLOCYBA CRATÆGI. (Page 143.)

Fig. 4.—Imago, showing a similar annulus.

Fig. 4 *a*.—Side view of the head, with its convex face.

TYPHLOCYBA ROSÆ. (Page 141.)

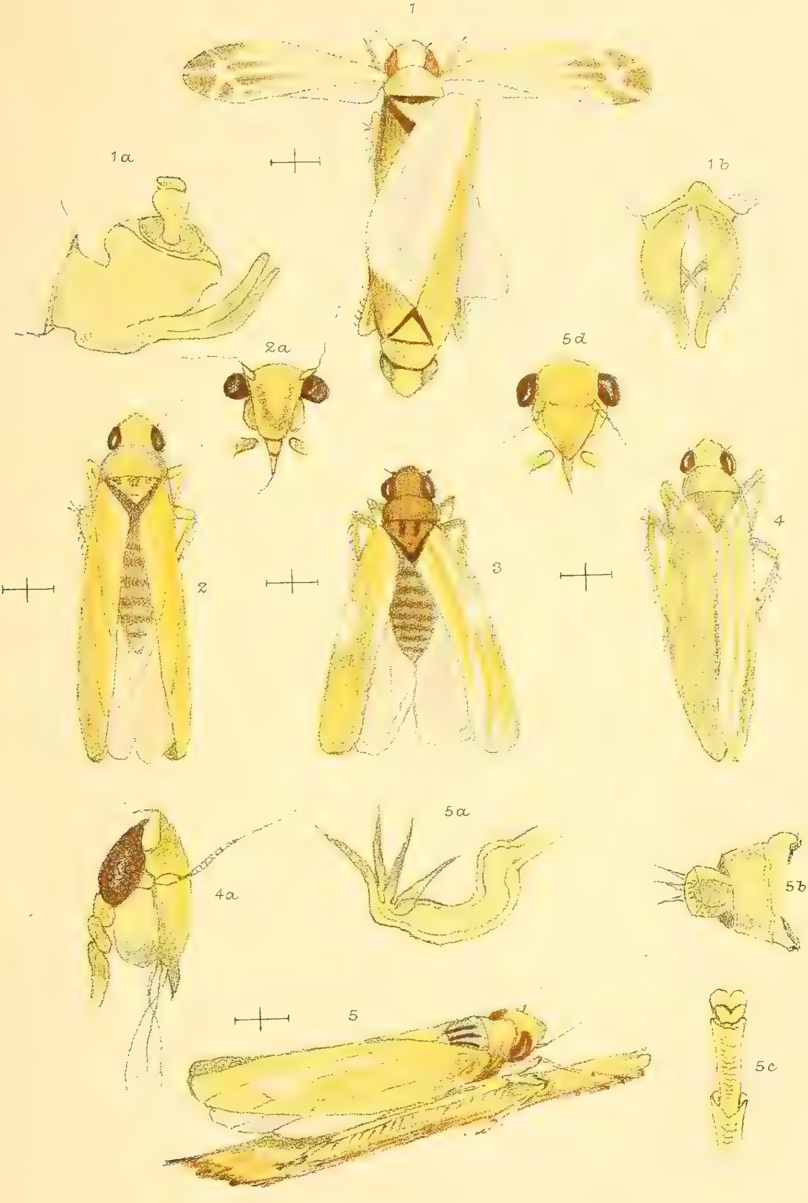
Fig. 5.—Profile view of the insect.

Fig. 5 *a*.—Penis, with its channel and terminal laminæ.

Fig. 5 *b*.—Anal termination of the female abdomen.

Fig. 5 *c*.—End of the fore-tarsus, apparently without claws.

Fig. 5 *d*.—Head and frons of the same insect.



G.B.B. del.et lith.

West, Newman chromo.

PLATE LXXIII.

TYPHLOCYBA SALICICOLA. (Page 143.)

Fig. 1.—Imago, with its notched pygofer.
Fig. 1 *a*.—Frons and clypeus.
Fig. 1 *b*.—Hind leg of the same insect.

ZYGINA TILIÆ. (Page 148.)

Fig. 2.—Imago. The black tarsi may be noted.

ZYGINA BLANDULA. (Page 147.)

Fig. 3.—Imago. The crimson elytral spots are very variable, some appearing as mere points.
Fig. 3 *a*.—Another specimen, seen in profile.
Fig. 3 *b*.—Head, showing the frons and clypeus.
Fig. 3 *c*.—Hind legs, with its tarsus.
Fig. 3 *d*.—Elytron, without a red band.
Fig. 3 *e*.—Plates at the anal extremity of the insect.

ZYGINA HYPERICI. (Page 149.)

Fig. 4.—Imago, from the Douglas collection.

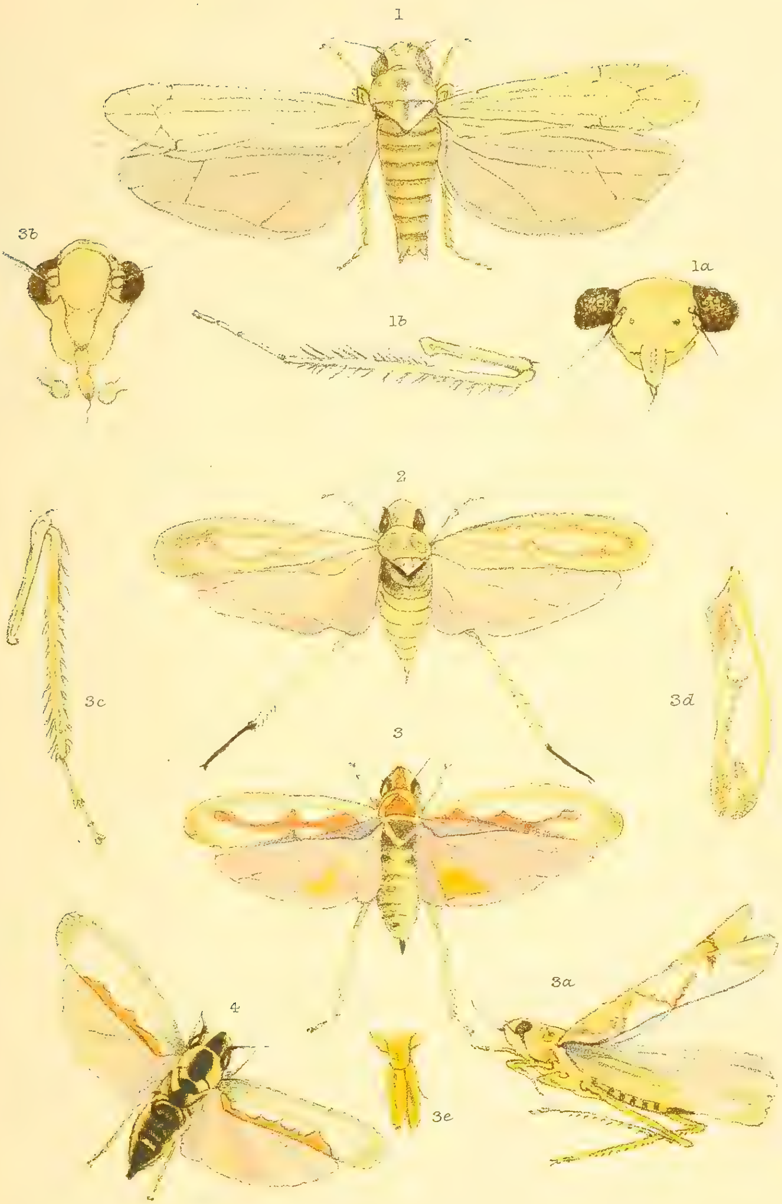


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PLATE LXXIV.

ZYGINA ALNETI. (Page 150.)

Fig. 1.—Imago. The pointed elytra may be noted.

ZYGINA PARVULA. (Page 150.)

Fig. 2.—Imago, with the sac of *Gonatopus* fixed to the upper abdominal ring.

ZYGINA SCUTELLARIS. (Page 151.)

Fig. 3.—Winged form. From Mr. Edwards' collection.

APHELOPUS MELANOLEUCUS. (Page 153.)

Fig. 4.—Imago. Figured from Mr. Fitch's collection.

Fig. 4 *a*.—Part of tibia and the tarsus of the same.

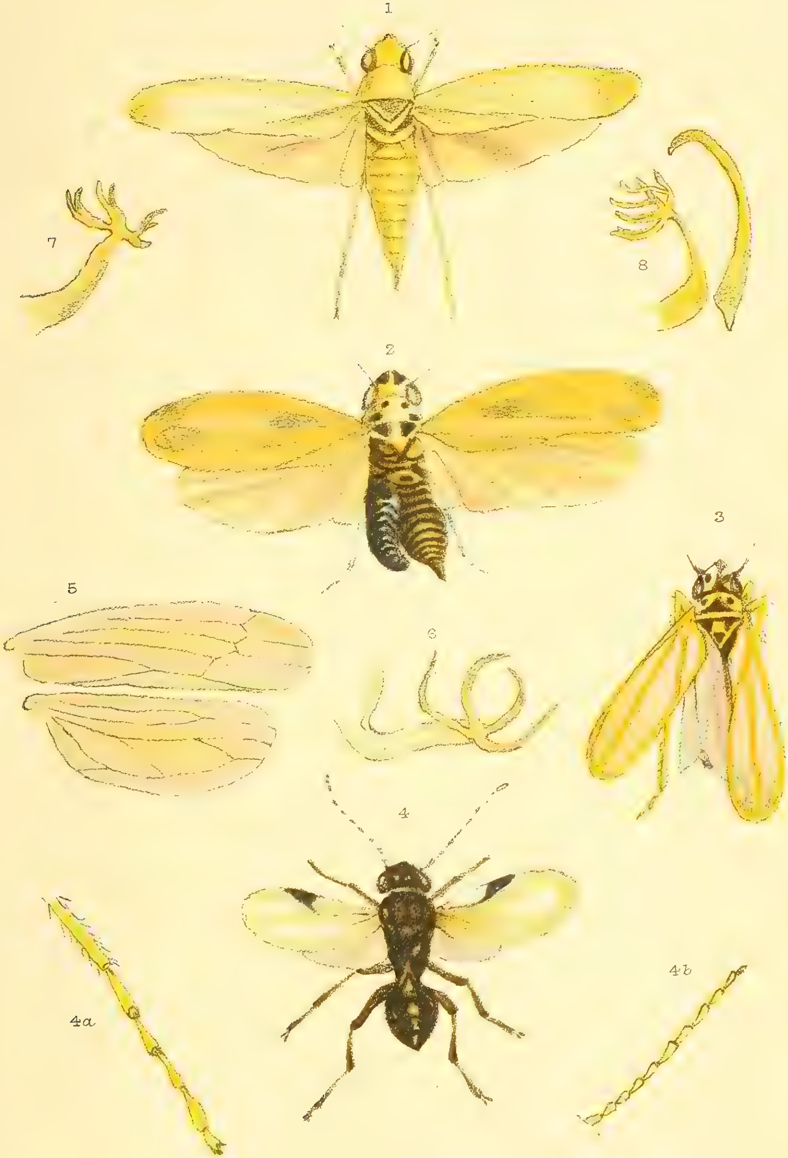
Fig. 4 *b*.—Antenna, apparently with eleven joints.

Fig. 5.—Elytron and wing of *Zygina blandula*, showing their neuration. A short transverse nervure of the wing has been omitted in the printing. Its almost exact representative may be found in the wing of *Typhlocyba*. See Plate LXIX., fig. 3 *a*.

Fig. 6.—The penis of *Typhlocyba rosæ*.

Fig. 7.—The penis of *Typhlocyba Letherryi*. Drawn after Edwards.

Fig. 8.—The penis of *Typhlocyba hippocastani*. Also after Edwards.



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INDEX TO VOL. II.

	PAGE
Acari in Tettigidæ	38
Acarus cicadarum	38
Acocephalidæ	7
— Irish varieties of	15
— likeness to Eupelix	15
— variability of	9
Acocephalus *adustus*, Hard.	14
— *agrestis*	32
— albifrons	9
— *arcuatus*	7
— *arenicola*	10
— *bicinctus*, Curt.	14
— bifasciatus	13
— brunneo-bifasciatus	12
— *cardui*	14
— *confusus*	7
— *costatus*	10
— *dispar*	13
— *fasciatus*	14
— flavostriatus	11
— histrionicus	10
— *interruptus*	13
— nervosus	14
— *nigrilis*	13
— *nigropunctatus*	7
— *obscurus*	14
— *pallidus*	14
— *polystolus*	7
— *tricinctus*	13
— *trifasciatus*	13
— synopsis of	35
Æstheticism in insects— Vol. I., lxxi; II., 190	
Acrotyle	Vol. I., 74
Agallia. See Index to Vol. I.	
Allebra albostriella	102
— Wahlbergi	103
Allygus commutatus	73
— mixtus	71
— modestus	73
Amber, Tettigides in	181
Amblycephalus irroratus	6
Anomia geometrica	132
— *gratiosa*	137
— *nitidula*	133
— *quercus*	131
— *rosæ*	141
— *saturalis*	137
— *sulphurella*	140
— *tenerrima*	139
— *ulmi*	136
— 10-*punctata*	135
Anoscopus *histrionicus*.	Vol. I., 11
Aphelopus	44, 153
Aphrodes *concinna*	7
— *juvenca*	52
— *melanopsis*	30
— *rivularis*	11
— *testudo*	7
Aphrophora. See Index, Vol. I.	
Apterodes *sabulicola*	58
Asiraca. See Vol. I.	
Ateleneura spuria	154
Athysanus *æmulans*	28
— brevipennis	31
— *canescens*	23
— *cognatus*	26
— communis	32
— *confusus*	29
— grisescens	26

	PAGE
Athysanus melanopsis	30
— obsoletus	33
— obscurellus	32
— *obtusifrons*	21
— *piceus*	33
— russeolus	27
— Sahlbergi	28
— *sex-punctatus*	33
— sordidus	29
— *Verralli*	21
— synopsis of	26
Atlantis, ideas on	178
Aurora and Tithonus— Vol. I., xi; II., 196	
Bibliography. Vols. I. and II.	
— of fossil insects	183
Blind Aphides	146
Bythoscopus. See Index, Vol. I.	
Cainozoic Tettigidæ	171
Carruthers and Schweinfurth's remarks on the persistence of species	180
Castration parasitraire	153
Cavelleta, fête in Florence	202
Centrotus. See Index, Vol. I.	
Cercopidæ. See Index, Vol. I.	
Cercopis abdominalis	52
Chant, modern, to Cicada	202
Chloriona. See Index, Vol. I.	
Chlorita flavescens	113
— viridula	111
Cicada. See Index, Vol. I.	
Cicada *abdominalis*	52
— *agrestis*	5
— *albifrons*	7
— *albo-striella*	102
— *aurata*	127
— *cuspidata*	3
— *balteata*	52
— *bicolor*	52
— *brunneo-fasciata*	12
— *carpini*	124
— *citrinella*	104
— *costalis*	70
— *cruentata*	75
— *depressa*	3
— *elegantula*	102
— *flavescens*	113
— *flavipennis*	108
— *flavo-striata*	11
Cicada *mixta*	71
— *nervosa*	21
— *nervosa*, Schr.	14
— *ocellaris*	67
— *pascuella*	54
— *plebeja*	80
— *prassina*	75
— *pulchella*	115
— *punctata*	93
— *quadrinotata*	86
— *russeola*	27
— *septenonotata*	85
— *serratula*	12
— *sordida*	29
— *splendiula*	76
— *striata*	51
— *striatula*	78
— *striola*	87
— *subfuscula*	81
— *tenella*	118
— *undata*	16
— *urticæ*	122
— *variata*	88
— *ventralis*	18
— *vittata*	119
Cicadetta montana. Vol. I.	
Cicadula elegantula	102
— *flavescens*	113
— *Germari*	116
— *orichalcea*	107
— *pulchella*	115
— *urticæ*	122
— *viridula*	111
— *vittata*	119
Clavaria on Cicadæ	37
Coins with Tettix	195
Colouring of Irish insects	194
Compsus albostriella	102
Dakyns, G. H., on the humanized Tettix	197
Delphacidæ. See Index, Vol. I.	
Deltocephalus abdominalis	52
— argus	57
— *assimilis*	56
— *arenicola*	58
— *bipunctipennis*	70
— brachynotus	56
— cephalotes	56
— citrinellus	56
— coroniceps	62
— costalis	59, 70
— distinguendus	60

	PAGE
Deltocephalus Falleni	57
— Flori	66, 69
— *fuscosignatus*	54
— *I. album*	55
— Linnei	55
— *longicaput*	53
— *luteolus*	54
— *Minki*	54
— *Mulsanti*	53
— Normani	63
— ocellaris	67
— ocellatus	68
— pascuellus	54
— picturatus	69
— *propinquus*	60
— *pseudo-cellaris*	60
— pulicaris	65
— punctum	59
— *quadrivittatus*	64
— repletus	68
— sabulicola	58
— socialis	64
— striatus	51
— *striifrons*	53
Deltocephalidæ, grouping of	71
Dicranura armata	107
— citrinetta	104
— flavipennis	108
— mollicula	105
— *pygmæa*	107
— similis	106
— variata	108
Die-sinking, ancient	198
Ditropis albomarginata.	Vol. I., 69
— borealis	„ 70
— *mæsta*	„ 70
Doratura stylata	19
Dryinus	154
Eocene Tettigidæ	171
Euacanthus. See Index, Vol. I.	
Eupelix cuspidata	3
— *spatulata*	3
Eupteryx abrotani	121
— *apicalis*	137
— auratus	127
— carpini	124
— collinus	120
— concinna	120
— filicum	116
— *flammigera*	147
— Germari	116
— *geometrica*	132
Eupteryx *hyperici*	149
— *jucundus*	131
— melissæ	128
— *nitidulus*	133
— notatus	123
— *ocellata*	136
— *parvulus*	150
— pulchella	115
— *quercus*	131
— *rosæ*	141
— *scutillaris*	151
— signatipennis	117
— stachydearum	126
— tenellus	118
— urticæ	122
— vittatus	119
— 10-*punctata*	135
— synopsis of	114
— hybernation and resistance to cold	129
Fossil Tettigidæ	164
Fungoid growths on Cicadæ	37
Gems and coins with Cicadæ	197
Galls, vegetable and animal	152
Geikie, Sir A., on date of amber-beds	172
General remarks on the genera of Tettigidæ	95
Genital segment, import of	100
Germar and Berendt on amber-insects	181
Glyptocephalus proceps	23
Gnathodus punctatus	93
Gonatopus, life-history of	41, 154
Graphocræerus ventralis	18
Grasshoppers and Cicadæ—	Vol. I., xvi
Greenland, fauna of	179
Greek coins with Tettix—	Vol. I., xix
Gum anime and copal	183
Homologies between parts of Heteroptera and Homoptera	158
Heer, on Swiss fossil insects	176
Issus. See index, Vol. I.	

PAGE

Jassus *abdominalis* . . 52
— *atomarius* . . 73
— *attenuatus* . 79, 91
— *cephalotes* . . 56
— *commutatus* . . 73
— *corniculus* . . 78
— *costalis* . . . 70
— *croceus* . . . 91
— *cruentatus* . . 75
— *frenatus* . . . 87
— *fumatus* . . . 88
— *grisescens* . . 26
— *intermedius* . . 87
— *longicornis* . . 90
— *metrius* . . . 91
— *mixtus* . . . 71
— *nervosus* . . . 21
— *ocellatus* . . . 67
— *pascuellus* . . 54
— *pectoralis* . . 81
— *phragmitis* . . 22
— *plebejus* . . . 32
— *porrectus* . . . 31
— *prassinus* . . 75
— *Preyssleri* . . 24
— *punctatus* . . 93
— *punctifrons* . . 78
— *quadrinotatus* . . 86
— *russeolus* . . . 27
— *reticulatus* . . 72
— *rivularis* . . . 11
— *rupicapra* . . 79
— *serratulæ* . . . 12
— *sexnotatus* . 84, 88
— *simplex* . . . 75
— *sordidus* . . . 29
— *splendidulus* . . 76
— *striatulus* . . 78
— *striatus* . . . 51
— *strigatus* . . . 51
— *striola* . . . 87
— *strigipes* . . . 86
— *stylatus* . . . 19
— *subfusculus* . . 80
— *subrusticus* . . 13
— *Torneellus* . . 78
— *variatus* . . . 88
— *virescens* . . . 83
Jurassic Tettigidæ . . 168

Kybos smaragdula . . 109

Larvæ surviving cold below 20° . . . 129

PAGE

Ledra aurita . . Vol. I., 89
Leland, C., on Tuscan myths 200
Liburnia. See Index, Vol. I.
Limotettix antennata . 90
— crocea . . . 91
— intermedia . . 87
— *lunifrons* . . . 87
— metrius . . . 91
— nigricornis . . 89
— quadrinotata . . 86
— septemnotata . . 85
— sexnotala . . . 84
— striola . . . 87
— sulphurella . . 83
— variata . . . 88

Macropsis. See Index, Vol. I.
Magnifying powers, easy reduction of . . 196
Megophthalmus. See Index, Vol. I.
Miaster, McLachlan on . 50
Michael, A., on Orabatidæ . 39
Mik, J., on Gonatopus 41, 152
Miocene Tettigidæ . . 176
Mites on Delphacidæ . 40
Mounting and preserving Cicadæ . . . 194

Nansen and Nordenskjold on Greenland gnats . 46
Naphthaline a preservative . 196
Notus *aridellus* . . 108
— *cephalotes* . . 108
— *citrinellus* . . 104
— *fascialis* . . . 105
— *flavipennis* . . 108
— *molliculus* . . 105

Olearus. See Index, Vol. I.
Oligocene Tettigidæ . . 173

Palæontina oolitica . . 167
Paramesus nervosus . . 21
— *obtusifrons* . . 21
— phragmitis . . 22
Parasites of Tettigidæ . 36
— often blind and degraded forms . . . 45
Pediopsis. See Index, Vol. I.
Penthotænia . . . 13
Pinus succinifer . . 173

	PAGE
Pipunculus parasitic	45, 154
Platymetopius undatus .	16
Praying Mantis . .	203
Protecting colours . .	188
Pygofer, notes on . .	156
Quaternary Tettiges . .	177
Quatrefages and Naudin, on sudden developments .	186
Rhætic Tettigidæ . .	169
Scudder, S., on fossil insects of Florissant . .	174
Signoret, on ocelli . .	1
Sharp, Dr., on evolution of abdominal segments	100, 159
— on genitalia of Heteroptera . . .	157
Specific character, remarks on	99
Sterilization, Giard on .	153
Stictocoris Preyssleri .	24
Strongylocephalus agrestis .	5
— megerlei . . .	6
Styles, prehensile organs .	159
Summary, general . .	184
Tettigometra. See Index, Vol. I.	
Tettigidæ, scentless, and eaten by birds . .	97
Tettix as a charm .	Vol. I., xi
— incantation to . .	203
— ancient significance of .	198
Thamnotettix *antennata* .	90
— attenuata . . .	79
— *crocea* . . .	91
— cruentata . .	75
— dilutior . . .	77
— *intermedia* . .	87
— *nigricornis* . .	89
— plebeja . . .	80
— prassina . . .	75
— *punctifrons* . .	78
— *quadrinotata* . .	86
— *reticulata* . .	73
Thamnotettix splendidula .	76
— striatula . . .	78
— subfuscula . .	81
— *sulphurella* . .	83
— torneella . . .	78
— variegata . . .	80
— *virescens* . . .	83
Triecphora. See Index, Vol. I.	
Trombidium and Phytopus .	39
Typhlocyba aurovittata .	134
— avellanæ . . .	142
— cratægi . . .	143
— debilis . . .	134
— Douglasi . . .	137
— geometrica . .	132
— gratiosa . . .	137
— hippocastani . .	144
— jucunda . . .	131
— Lethierryi . .	140
— nitidula . . .	133
— opaca . . .	144
— pruni . . .	145
— pygmæa . . .	138
— quercûs . . .	131
— rosæ . . .	141
— salicicola . . .	143
— sexpunctata . .	135
— tenerrima . .	139
— ulmi . . .	136
— *Zetterstedti* . .	131
— destructive to the hop .	125
— habits of . . .	100
— synopsis of . .	146
Ulopa. See Index, Vol. I.	
Wallace, A. R., on the geological difficulty . .	204
Wing neuration, remarks on	98
Zygina alneti . .	150
— blandula . . .	147
— hyperici . . .	149
— parvula . . .	150
— scutellaris . .	151
— tiliæ . . .	148

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